

# 73 Amateur Radio Today

JULY 1993  
ISSUE #394  
USA \$2.95  
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A WGI Publication  
International Edition

## MORSE MOBILE

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W.P.M.

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## Installing N Connectors

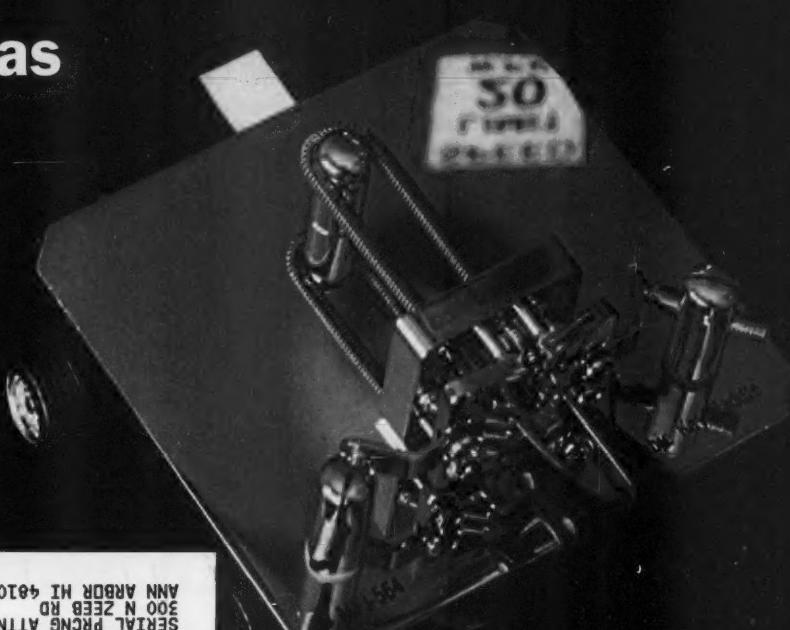
## Stacking UHF Antennas

## 73 Reviews

AEA Hamlink

HP Digital  
Multimeter

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# Choose Your Mobile In 3 Easy Steps:

## Step 1 Choose Your Bands!

### ■ Single Band: 2 Meters

Today's most popular band, the best place for new hams to meet old hands, learn good operating procedures. Very friendly, thousands of open repeaters & autopatches everywhere. Great for on-the-road help. Crowded, though, especially in cities. Single-band mobile is easy to learn & use. No-Code friendly!

### ■ Multiple Band: 2 Meter/440MHz

The two most popular FM bands. A "natural" mix of high activity & special group channels, this is becoming the amateur's favorite mobile rig. Instant control of either band, and you can set up your station as a crossband full-duplex repeater. Gateway into advanced operating systems unavailable on 2M.

### ■ 440 MHz

Next most popular band, less crowded with more high-tech, "smart" repeaters offering autopatch, remote base, linking, digital-voice recording. Some are limited-access (PL). Allows crossband repeating between singleband handhelds & dualband mobiles. 440 gives access to advanced technical info. This is where the pros hang out! No-Code friendly!

### ■ 2 Meter/220MHz

For the unconventional, this combines the most popular & the least crowded bands. Gives access to the people & services on 2M, plus the privacy & open space of 220, plus the advantages of telephone-like duplexing. Valuable where privacy is a concern.

### ■ 220MHz

Fairly quiet, less crowded than 440, with almost half as many repeaters and the same high-tech functions. Plenty of open channels for semi-private conversation. Great place to meet newcomers, youngsters. Ideal for ham family, since all classes have voice privileges on 220. No-Code friendly!

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### ■ ■ ■ MultiBand

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### IC-229H 2 Meters



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1-800-289-0388

Foreign Subscribers  
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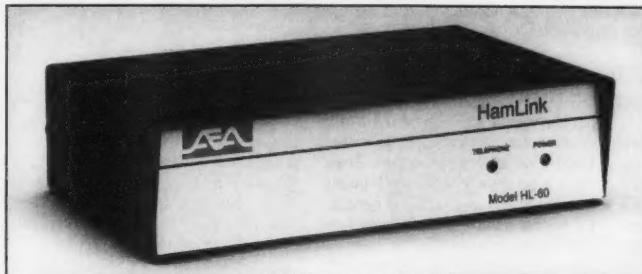
Audit Bureau  
of Circulations  
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Reprints: \$3.00 per article  
Back issues: \$4.00 each.  
Write to 73 Amateur Radio Today, Reprints,  
70 Route 202N, Peterborough, NH 03458.

Printed in the U.S.A. by Quad  
Graphics, Thomaston, Georgia.

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Photo by David Cassidy N1GPH.*

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Circulation Offices  
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# NEVER SAY DIE

Wayne Green W2NSD/1



## Eureka! I've Got It!

Unless your short-term memory system has been short-circuited by Alzheimer's, you should recall my grousing about the road blocks our stupid simplex communications system presents to those few of us interested in even attempting to talk about more than the weather or an endless recitation of our rig model and serial number.

Simplex . . . where we have to talk one at a time. Where the other chap prattles on endlessly, repeating everything three times . . . only "everything" turns out to be more like nothing. And where there's no way to break in and tell him "enough already." Or even interject an "uh-huh" now and then. Well, we'd save a bundle on telephone calls if they worked that way.

Duplex . . . where a person can enter into an actual conversation. It's no wonder we hams tend to talk about nothing over the air. We start out in life learning to talk using two-way instantaneous communications. We even have the advantage of being able to see the other person, which makes the use of hand gestures and body language enter into the communication process.

There was an entertaining squib on one of the recent TV magazine shows showing people animatedly talking on telephones in street phone booths. There was a great waving of hands and even arms as they talked.

Well, it's going to be awhile before we're able to organize duplex ham TV, bandwidth limitations being what they are, but I've thought of a way we can quickly get going with duplex contacts on our HF bands. Imagine being able to hold an actual conversation with a DX operator on 15 or 20m!

It's those confounded showers that do it to me. As I say, I've been grousing about this situation, asking you for a solution. So, there I was in Dayton, on the morning of the opening of the Hamvention, taking a shower. Bam! It hit me! Of course, the answer is simple.

Most of my really ingenious ideas come to me in the shower. My employees cringe when I come in to work and say, "Hey, while I was taking a shower this morning . . ." They know this probably means we're about to start a new business. Eyes roll. A lot of other

people have written about the same phenomenon. It apparently has something to do with negative ions. They have a positive effect. I've thought about putting in a negative ion generator, but one shower a day is all my employees can handle.

The problem we need to solve with simplex operation is the blocking of our receivers by our transmitter. No, we don't have to design new receivers which can unblock in a microsecond, we can do just fine with the receivers we're using right now. And no, I'm not talking about transmitting on one end of the band and listening on the other. For most of us that would still zap our receivers. Crossband? Well, almost. Now, if you'll stop trying to second-guess me and let me explain . . .

One easy way to be able to listen on your own frequency while you're transmitting is to separate your transmitter and receiver by a mile or two. Did that light up anything for you, or do I have to go into the detail? Let's pretend that you have a ham friend a couple miles away. It could happen. And let's just imagine that you might be able to work out a deal with him so that the two of you could operate at different times and use each other's rigs. All you need is either a telephone link, which isn't expensive, or a UHF link, which also isn't expensive. My choice would be 10 GHz for the link. We've got 500 megahertz up there sitting totally unused . . . a sure recipe for its loss, if the FCC ever gets short of frequencies.

10 GHz transmitters are a cinch to make. And all it takes is about a tenth watt to work anywhere you can see. A few years back WA1KPS knocked together a pair of 10 GHz transceivers in boxes about half the size of a half-gallon milk carton. The antenna was a small horn coming out one side. With these we racked up a seven-state contact record. I worked him in seven different states and Chuck worked New Hampshire seven times.

With a radio or telephone link we can "ventriloquize" our voices by a mile or five and thus be able to listen on our own frequency while we talk. Or any other frequency, if we want to work split-channel. Of course, if you both want to operate at the same time then you'll have to go back to simplex

until the urge passes. I'll bet that once you get used to duplex, going back to simplex will be worse than watching TV on a small black and white set with a rabbit-ear antenna.

Yes, I know . . . both ends of any contacts will have to be set up with remote transmitting to make this work. So, we'll have to start setting up some special frequencies for duplex pioneers to meet. I'm open for suggestions. 14.313? Sure, why not. No one is using that frequency right now. It's about time we put it to constructive use. We could start in the 14,300-14,320 kHz part of the band and gradually expand. When SSB first got going it was started at the top end of 20m and gradually moved on down the band, squeezing out AM until it was all gone.

We're already seeing some sophisticated devices for remotely tuning our transmitters and even swinging our beams. If we can get duplex into action we'll see a lot more of these magically appearing in our ad pages as entrepreneurs get into the business. Eventually we'll start seeing remote control circuits built into our transceivers.

You say this must be illegal? Go soak your head! With sideband we have no carrier, so when we're listening we're not transmitting. This is perfectly legal.

Please let me know when you get set up for duplex so I can pass along the news in 73, thus encouraging others to get off their fat butts and get set up so you can talk with you.

The downside of all this is that after all these years of having never said anything of significance during a contact, are you going to be able to actually talk with people? Can you hack that? This may take some getting used to.

Remotely controlling the rig is a snap. Over 20 years ago I hooked up a spare Standard Radio 2m repeater to my 20m rig so I could operate it from anywhere in town. I was into morning mountain climbs up Pack Monadnock mountain, so I'd take along my little HT and talk with 20m ops all around the world while I got my daily exercise. It sure took the boredom out of the walk. Then I took the repeater over and set it up in Amman as JY73 . . . and left it there, along with

a suitcase full of HTs. I remember saying good-bye to King Hussein via the repeater as I was boarding the plane heading for Cairo and then home.

So, once freed from the tyranny of simplex, what are you going to talk about? Your rig? The weather? Cocktail party chit-chat? Can you stick to something you actually know about or are you going to get off into deep water with things where you have to substitute intuition and belief for thought? There's a lot of that going around.

## The Biggest Change Since Repeater

It's about time we got something new going. In the late '50s we got going with sideband. In 1969 we started with repeaters, which by 1973 became the largest activity in the hobby. In the 1980s we got interested in packet, but this hasn't been the grabber we had with sideband and repeaters. Perhaps in the '90s we can make duplex our new pioneering effort.

I can see clubs setting up HF transmitters at their repeater sites so club members can access the system and take advantage of the site and the distance from their home operating position. I've got a great hamshack location in Hancock (NH), complete with a tower and beam. I'd love to get it set up so anyone able to access the W2NSD/1 repeater could use this as a remote transmitter. I even have a repeater all set up we could use for the project. With some of today's rigs we should be able to remotely change bands, tune any frequency, and swing the beam. We might even figure out how to allow several ops to use it simultaneously so three or four could chat with South Africa just like they were all in the same room.

If you like the idea and try it out, this is an invitation to write about it. I'd like to see articles on control systems and reviews of any applicable commercial products. '73 helped sideband grow in the '60s. It helped repeaters grow in the '70s. We even helped packet in the '80s. Can we do it again with duplex? I think this could be the greatest thing that ever happened to amateur radio.

If any manufacturers are interested in working with us on this project I'd like to hear from them. Once we have something going I'll be devoting a good deal of space in '73 to the project. This will also give us something exciting to tell the general public. Yes, I'll be doing videos and getting them on TV stations wherever possible.

If we're going to keep our bands we've got to do a whole lot more than we've been doing to hold our franchise. We need to figure out how to attract youngsters by the millions, not by the dozens. We need to sell amateur radio and school radio clubs as a way for America to build the high-tech work force it must have to compete in the world of 2000 and 2020. The last thing we need is some 2020 hindsight telling us what we should have done in the '90s.

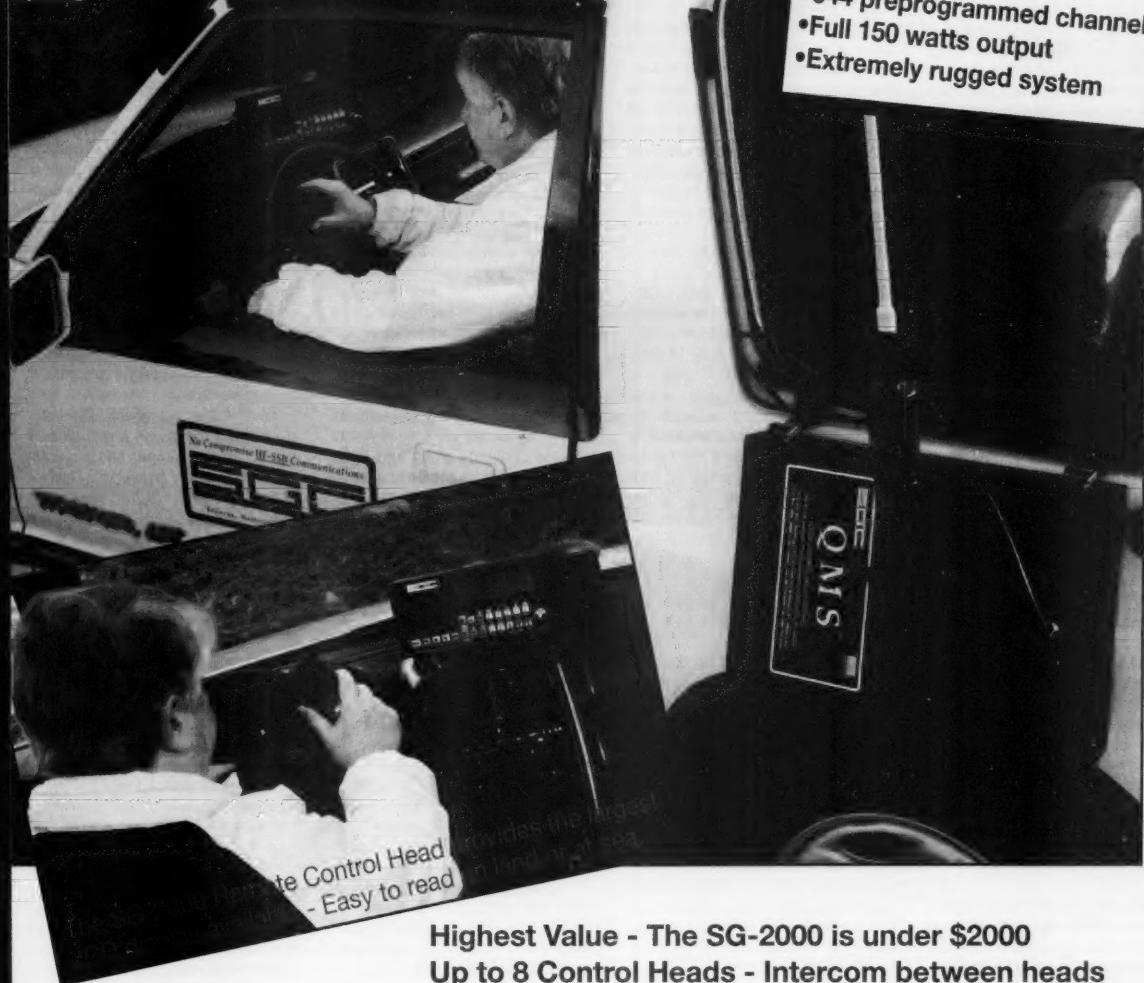
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# LETTERS

Number 2 on your Feedback card

## From the Hamshack

**Greg Smith N8PPZ, West Carrollton OH** Wayne, thank you for getting me up off my duff and upgrading. Thanks to you I finally passed the 5 wpm code test after taking it several times and failing because I procrastinated and did not really spend enough time studying. It's your fault that I am now a General, that I just couldn't stop, and I blame you, sir, for the fact that I am now trying to pound the Advanced theory into my head. Before I insult you too much, I just want you to know that I now see a reason to go on and get my Extra Class; because I WANT TO! Maybe I am foolish to think that the conversations on the lower bands are more interesting than they are on 10 meters and VHF. I am tired of an endless string of signal reports and 2 meter drive. I guess it is too much to hope for (call me a dreamer), but I'll probably call you every name in the book if I find out that all other hams want are signal reports and QTH.

On a happier note, I did write to you before and what you wrote back caused me to do the above and more. I have now founded the Sinclair Community College club, and it is going well. I got a promotion at work, and in addition to operating a three-camera robotic studio camera system I am doing news writing and some assignment desk duties.

Last year at Dayton I talked with you and mentioned an idea about a new business. I guess I spoke too loudly because somebody else used my idea and started VIDEO ELMER. I lost out, dangnabit! I had to think of something else, and I did. I sent out on the national ham radio echo on RelayNet series of essays I called "How To Fix a Nation." These contained my ideas for fixing our miserable schools and ending the problem of teen violence. Unfortunately, I found out just how much other people think about these problems. People are too status quo and passive. I guess they just need somebody to give them a swift kick in the right direction.

**Jeff Carter KK6RY, Simi Valley CA** I agree wholeheartedly with you concerning the public school situation. I might also add that I agree with your attitude concerning the ARRL. I am a past member who opted not to renew. I decided to do this for a couple of reasons: one, the whole no-code fiasco; and two, the fact that I do not believe we are being represented in the most efficient way in Washington, DC, by the powers that be. If the ARRL is supposed to be our "mouthpiece" in FCC affairs and all the other political rot that goes on at Capitol Hill, then they are utter failures . . . If

we are to save frequencies from further degradation to commercial interests, we must put the technical-minded nature of the hobby back in the forefront and stop this selling out to the "big gun" commercial interest groups and others with their fingers in the spectrum pie. Next time there is an earthquake, fire or flood of disastrous proportions, let the dummies call UPS, their tow truck company, or any other VHF and above user for help! I think you get my drift.

As a VE, I have also seen the mess with the licensing system. I have turned in my badge, cut in two, and told the ARRL to stuff it. With the no-code situation thus promoted, all we have accomplished is a mass flooding of the system with a bunch of handle-talkie-wielding appliance operators. Sorry Wayne, I don't buy it! This strength in numbers jazz just doesn't cut it for me. Yea, I know, technology marches on and all that stuff . . . but I, being an ex-USCG radio man in the '70s, well realized the value of CW for daily and emergency communications. I don't like the "slighting" I see of this mode of communication. I am an avid QRP nut and also a member of the Society of Wireless Pioneers and believe in the preservation of CW and older radio history. Let the no-coders run the local bicycle races and show off with their \$500 handle-talkies. I'm not impressed. I'll stick to my 2 watt CW rigs, which I built myself, and take pride in my operating practices. To each his own, they say, but I don't care if I ever get on an FM repeater again. The trashing of VHF/UHF will end up ruining it for us all.

**Dan R. Cation WB0SHN, Savonburg KS** Wayne, I am writing in response to two letters that recently appeared in *73 Magazine*. Both mentioned traffic radar and the allegations that its use may cause cancer. I would like to take exception to the first letter from Mr. Beegan in the February 1993 issue and to your personal comment that appeared following Mr. Mayer's letter in the April 1993 issue stating that ". . . there is plenty of evidence (facts) that prolonged use can cause serious problems for officers . . ." I would also like to thank Mr. Mayer for his comments.

First of all, to set the records straight concerning the lawsuits mentioned by Mr. Beegan, out of 13 lawsuits filed against Kustom Signals, nine have been dismissed for various reasons before even getting to court. One has made it to court and I'm sure that the plaintiff would have liked to speak to you before going to court . . . they lost . . . by the unanimous verdict of eight jurors, after about three hours of deliberation.

Just to let you know where I'm coming from, I am not a self-proclaimed microwave expert or anything like that. What I am is one of the proud employees of Kustom Signals, who has worked for them for over 18 years. No, I don't work on the radar products. I am not a member of management or an engineer. I am currently an engineering technician and have worked as a technician somewhere in the plant for those 18-plus years. You would think that if one officer using one radar a few hours a day could cause cancer, then the technicians who test these radar units (currently around 25 units a day, nine to 10 hours a day, four to five days a week) would see some ill effects. I personally know one technician who has been doing just this . . . for close to 20 years! Kustom is very proud that it has many long-term employees who, like myself, have been sitting around in this steel building in Chanute, Kansas, for 10, 12, 15, 18, and even 20 years and longer with these "KILLER" microwaves bouncing around us. Guess what? There hasn't been one case of cancer or any other strange unexplained illness in any of Kustom's employees.

We are a small, privately-owned company of a little over 100 employees. We are not some corporate giant. These lawsuits nearly cost us all our jobs, in an area where there are very few jobs available. They did cost some of our co-workers their jobs (in a layoff) and caused the company to take such belt-tightening measures as going to a four-day work week just to keep the company going and to be able to defend ourselves against these allegations. We still have at least two more lawsuits to defend ourselves against. I would like to know where these "facts" that you speak of are. We sure haven't seen any from any reputable sources yet. By the way, I haven't seen any melted hood ornaments or dead birds from our radar, either. And, as one of our co-workers who recently retired (in good health) put it: Hell No, We Don't Glow!

Thanks to Mr. Mayer for his realistic point of view.

**Dan—Thanks for your letter . . . I can understand your concern.**

*If successful lawsuits were a measure of dangers, that would be positive proof that cigarettes pose no danger to health. The asbestos industry fought the same battle for years . . . successfully. Now the power companies are also fighting the same battle against scientific research.*

*I don't doubt that you haven't seen any proof. But then I doubt that you have made any effort to look. Have you accessed the 73 BBS yet and gotten a download of a list of the scientific papers in this field? The list is over 20 pages long and growing every week. I just got in a new stack an inch high from the leading researchers.*

*The damage these fields are doing is insidious. There are a few exam-*

*ples of the extremes, but the research scientists are just beginning to understand the lower level effects. How much do you know or have you tried to learn about how the cells of your body function and communicate? And what happens to you when this communication is interfered with by a radio or magnetic field?*

*Have you seen any of the videos of police officers who have gotten repeated brain tumors right in the area where their radar antenna has been blasting their heads? Now we're starting to see the same thing happening with cellular telephones which are operated close to the head. But do you really think that a field which can do that to heavy users isn't doing anything at all to lighter users?*

*Not that I have much compassion for traffic radar manufacturers. Have you any research reports which show that the use of traffic radar significantly saves lives? There are endless reports showing that police radar is a major source of funding for towns, but that seems to be its use. Most accidents happen at low speeds. Higher speed accidents tend to involve alcohol.*

*Studies show that, lacking speed limits, people tend to drive at the speeds they are most comfortable with and thus the accident rate is lower than when speed limits are imposed. The research reports on this have been cited in the car magazines for years . . . as have the absence of refuting studies.*

*Your product is probably only actually killing a few dozen police officers a year, so this danger has probably been blown out of proportion. That's a reasonable price to pay for the income radar guns bring to towns. It's a good trade-off. As we find out what the less-than-lethal doses are doing to people, we can re-evaluate the product in terms of its benefits to society . . . Wayne*

**N. B. Sadorian N6WGX, Montebello CA** It was a great surprise for me to see my request for information on Motorola's amplified speaker model number 2005B printed in your "Ham Help" column (February 1993).

You will be pleased to know that I am one of those who reads your magazine cover to cover. You should also know that there must be plenty of others out there who apparently do the same. Within the last two weeks I have received not one but two responses with the correct information from fellow ham readers. Although I know I would have done the same, I somehow thought that no one else would pay any attention to the "small problem" I had with a little speaker unit. I really made my day and got me thinking that the world is not that bad yet, as long as there are decent people like you and the rest of us hams who would walk the extra mile to help another human being.

Thanks again for helping your readers, and keep up the excellent work you do with your magazine. ■

## Low Cost GaAsFET PREAMPS

### LNG-(\*)

**ONLY \$59**  
wired&tested



#### FEATURES:

- Very low noise: 0.7dB vhf, 0.8dB uhf
- High gain: 13-20dB, depends on freq
- Wide dynamic range - resist overdrive
- Stable: low-feedback dual-gate FET
- \*Specify tuning range: 26-30, 46-56, 137-152, 152-172, 210-230, 400-470, 800-960 MHz.

### LNW-(\*) MINIATURE PREAMP

**ONLY \$29** kit, **\$44** wired&tested

• GaAs FET Preamp similar to LNG, except designed for low cost & small size. Only 5/8" W x 1-5/8" L x 3/4" H. Easily mounts in many radios.

\*Specify tuning range: 25-35, 35-55, 55-90, 90-120, 120-150, 150-200, 200-270, 400-500 MHz.

### LNS-(\*)

#### IN-LINE PREAMP

**ONLY \$89** kit, **\$119** wired&tested

- GaAs FET Preamp with features similar to LNG series, except automatically switches out of line during transmit. Use with base or mobile transceivers up to 25W. Tower mounting brackets incl.

\*Tuning range: 120-175, 200-240, or 400-500.

### HELICAL RESONATOR PREAMPS

- GaAs FET preamps with 3 or 4 section helical resonators reduce Intermod & cross-band interference in critical applications. MODEL HRG-( \* ), \$80 vhf, \$110 uhf. \*Specify tuning range: 142-150, 150-162, 162-174, 213-233, 420-470.

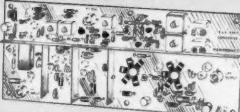
## RECEIVING CONVERTERS



Low noise converters to receive vhf and uhf bands on a 10M receiver.

- Kit less case \$49, kit w/case & BNC jacks \$74, wkt in case \$99.
- Input ranges avail: 50-52, 136-138, 144-146, 145-147, 146-148, 220-222, 222-224 MHz, 432-434, 435-437, 435-437.5, and 439.25 (to chan 3).

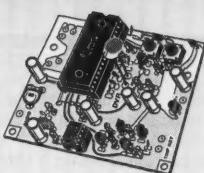
## TRANSMITTING CONVERTERS



XV2 for vhf and XV4 for uhf. Models to convert 10M ssb, cw, fm, etc. to 2M, 220, 222, 432, 435, and atv. 1W output. Kit only \$89. PA's up to 45W available.

- Buy at low, factory-direct net prices and save!
- For complete info, call or write for free catalog.
- Send \$2 for overseas air mail.
- Order by mail, fax, or phone (9-12 AM, 1-5 PM eastern time.)
- Min. \$5 S&H charge for first pound plus add'l weight & insurance.
- Use VISA, Mastercard, check, or UPS C.O.D.

## ACCESSORIES



### DVR-1 DIGITAL VOICE RECORDER

Module. Primarily a voice ID'er for repeaters. May also be used as a contest CQ caller or as a "radio notepad" to record up to 20 seconds of received transmissions for instant recall. As a repeater ID'er, it will record your voice, using either the built-in microphone or an external mic. It can be used with almost any repeater COR module. As a contest caller, you can record a message or even several messages and play them through your transmitter at the press of a switch. As a radio notepad, you can keep it wired to the audio output of a receiver ready to record up to 20 seconds of anything you might want to recall later. Play it back as many times as you like through a small external speaker. (Call for more information) ...kit \$89, wkt \$139

TD-3 SUBAUDIBLE TONE DECODER/ENCODER. Adjustable for any tone. Designed especially for repeaters, with remote control activate/deactivate provisions ...kit \$29, wired & tested \$69

COR-3 REPEATER CONTROLLER. Features adjustable tail and time-out timers, solid-state relay, courtesy beep, and local speaker amplifier ..... kit \$49

CWID. Diode programmed any time in the field, adjustable tone, speed, and timer, to go with COR-3 ..... kit \$59

COR-4. Complete COR and CWID all on one board for easy construction. CMOS logic for low power consumption. Many new features. EPROM programmed; specify call ..... kit \$99, wkt \$159

TD-2 TOUCH-TONE DECODER/CONTROLLER. Full 16 digits, with toll-call restrictor, programmable. Can turn 5 functions on/off. Great for selective calling, too! ...kit \$89, wired & tested \$149

TD-4 SELECTIVE CALLING MODULE. Economy touch-tone decoder with latching output. Primarily designed to mute speaker until someone calls you by sending 4-digit signal but may also be used to turn on autopatch or other device ..... kit \$49, wkt \$89

AP-3 AUTOPATCH. Use with above for repeater autopatch. Reverse patch and phone line remote control are std. ....kit \$89, wired & tested \$149

AP-2 SIMPLEX AUTOPATCH Timing Board. Use with above for simplex operation using a transceiver ..... kit \$39



MO-202 FSK DATA MODULATOR. Run up to 1200 baud digital signals through any fm transmitter with full handshakes. Radio link, computers, telemetry gear, etc. .... kit \$49, wkt \$79

DE-202 FSK DEMODULATOR. For receive end of link. .... kit \$49, wkt \$79

9600 BAUD DIGITAL RF LINKS. Low-cost packet networking system, consisting of MO-98 Modem and special versions of our 144, 220 or 450 MHz FM Transmitters and Receivers. Interface directly with most TNC's. Fast, diode-switched PA's output 15 or 50W.

**Real-Speech Voice ID Option Available With DVR-1 Digital Voice Recorder Shown At Left!**

## REP-200 REPEATER

A microprocessor-controlled repeater with autopatch and many versatile dtmf control features at less than you might pay for a bare-bones repeater or controller alone!

We don't skimp on rf modules, either! Check the features on R144 Receiver below, for instance: GaAs FET front-end, helical resonators, sharp crystal filters, hysteresis squelch.

**Kit \$1095; wkt only \$1295!**  
Voice ID Option \$189.



Other models available:

**REP-200V Economy Repeater.** As above, except uses COR-4 Controller without DTMF control or autopatch. **Kit only \$795.**

**REP-200N Repeater with no controller.** For use with external controller, such as those made by ACC. **Kit only \$695, wkt \$995.**

• Available for the 50-54, 143-174, 213-233, 420-475, 902-928 MHz bands.

• FCC type accepted for commercial service (hi-band and uhf).

• Rugged exciter and PA, designed for continuous duty.

• Power out 20W 50-54MHz; 15W (25W option available) 143-174MHz; 15W 213-233 MHz; 10W 10W 902-928MHz.

• Available add-on PA's up to 100W.

• Six courtesy beep types, including two pleasant multi-tone bursts.

• Open or closed access autopatch, toll-call restrict, auto-disconnect.

• Reverse Autopatch, two types: auto-answer or ring tone on the air.

• Pulse (rotary) dial option available.

• DTMF CONTROL: over 45 functions can be controlled by dtmf command. 4-digit control code for each function.

• Owner can inhibit autopatch or repeater, enable either open or closed access for repeater or autopatch, and enable toll calls, reverse patch, ker-chunk filter, site alarm, aux rcvr, and other options.

• Cw speed and tone, beep delay, tail timer, and courtesy beep type can be changed at any time by owner password protected dtmf commands.

• Auxiliary receiver input for control or cross linking repeaters.

• Many built-in diagnostic and testing functions using microprocessor.

• Color coded LED's indicate status of all major functions.

• Welded rf-tight partitions for exciter, pa, receiver, and controller.

• 3/4 inch aluminum rack panel, finished in eggshell white and black.

## XMTRS & RCVRS FOR REPEATERS, AUDIO & DIGITAL LINKS, TELEMETRY, ETC.

Also available in rf-tight enclosures, and with data modems.

**FM EXCITERS:** 2W continuous duty. TCXO & xtal oven options. FCC type accepted for com† high band & uhf.

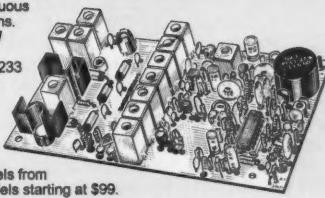
• TA51: 50-54, 143-174, 213-233 MHz ...kit \$109, wkt \$189.

• TA451: 420-475 MHz ...kit \$109, wkt \$189.

• TA901: 902-928 MHz, (0.5W out); wkt \$219.

• VHF & UHF AMPLIFIERS.

• For fm, ssb, atv. Output levels from 10W to 100W. Several models starting at \$99.



FM RECEIVERS:

• R144/R220 FM RECEIVERS for 143-174 or 213-233 MHz. GaAs FET front end, 0.15uV sensitivity! Both crystal & ceramic if filters plus helical resonator front end for exceptional selectivity: >100dB at ±12kHz (best available anywhere!) Flutter-proof hysteresis squelch; a/c track, drift, .... kit \$149, wkt \$219.

• R451 FM RCVR, for 420-475 MHz.

Similar to above, .... kit \$149, wkt \$219.

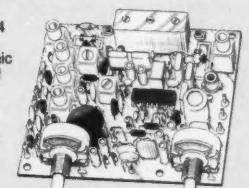
• R901 FM RCVR, for 902-928MHz.

Triple-conversion, GaAs FET front end.

...\$169, wkt \$249.

• R76 ECONOMY FM RCVR for 28-30, 50-54, 73-76, 143-174, 213-233 MHz, w/o helical res or a/c. .... Kits \$129, wkt \$219.

• R137 WEATHER SATELLITE RCVR for 137 MHz. Kit \$129, wkt \$219.



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## RF Effects Docket Issued

The FCC has released a Notice of Proposed Rule Making to update guidelines and methods used for evaluating the environmental effects of radio frequency radiation. The commission is using the 1992 RF exposure standards adopted by the American National Standards Institute and the Institute of Electronic and Electrical Engineers.

In 1985 the FCC adopted 1982 ANSI guidelines, which resulted in some transmitting facilities being required to prepare an Environmental Assessment if they would expose humans to RF levels greater than those recommended by the guidelines. Under the 1985 guidelines, many low power, intermittent, or normally inac-cessible RF facilities were not affected by these FCC rules, including amateur radio stations.

The 1992 ANSI guidelines are more restrictive of RF radiation, and they also extend the frequency range under consideration from 3 kHz to 300 GHz. The new guidelines also specify two sets of exposure recommendations: one for "controlled environments" (usually involving workers), and one for "uncontrolled environments" (usually involving the general public).

Hand-held devices are treated for the first time in the new ANSI guidelines. The 1982 guidelines excluded devices that did not exceed a "specific absorption rate" (SAR) or whose input was 7 watts or less. The 1992 guidelines also contain low power exclusions, but they are more stringent and could require manufacturers to demonstrate compliance with SAR requirements.

The comment date in this docket, ET 93-62, is August 13, 1993. The reply comment date is September 13, 1993. *TNX Westlink Report, Number 648, April 29, 1993.*

## HF Digital Mode R.M. Released

The FCC has issued a Public Notice on the ARRL proposal for digital rules for the amateur high frequency bands. The proceeding, which bears the file number RM-8218, originated with submission of the request by the League on February 1, 1993. Copies of the 36-page paper may be obtained from the Regulatory Information Branch at ARRL headquarters. Enclosing a large self-addressed envelope bearing six units of first class postage will speed the reply. *TNX ARRL, Westlink Report, Number 648, April 29, 1993.*

## Midland is Back

Midland has returned to the amateur marketplace! The company generally credited with bringing the 1-1/4 meter band to life in the mid-1970s with its relatively inexpensive model 13-509 transceiver now has its own 2 meter handheld and a full line of mobile antennas. The 73-005 is a relatively inexpensive, yet full-feature, 2 meter talkie that weighs only 6.5 ounces, receives 128 to 174 MHz, and has up to 5 watts output using an optional battery pack (2 watts with the standard pack), 0.16 µV sensitivity and 200 milliwatts of receiver audio, all packed into a 5-1/2" x 2-1/8" x 1-5/16" case and priced at

\$288. For mobile operation, Midland now has a full line of magnetic-mount, NMO mount and glass-mount 2 meter and dual-band antennas ranging in price between \$28 and \$40. For more information on this new radio and the antennas, visit a factory-authorized Midland dealer.

## Form 610 Change

The FCC says that hams no longer need to enter their transmitter location when filling out a Form 610 Amateur License Application Form. This information has heretofore been required on line 8. This would also seem to imply that section 2H (Change in Station Location) is no longer necessary. This change in filing requirements appears to be a cost-cutting move to reduce the labor involved in data entry for amateur radio Part 97 licenses. *TNX W6NLG, Westlink Report, Number 646, March 31, 1993.*

## Novice/Tech 30 Meter Petition Denied

The FCC has denied a petition to grant Novice and Morse-code-certified Technician Class licensees access to the amateur 30 meter band. The petition, by William G. Welsh W6DBB, asked that such licensees be allowed CW operation from 10.1 to 10.15 MHz. Welsh argued that the 40, 15 and 10 meter bands currently occupied by Novices and Technicians are becoming less useful due to changing sunspot conditions and interference from shortwave broadcast stations. He also said that the longer antennas needed for operation on 30 meters limited the appeal of that band for Novices and Technicians.

The FCC said that in opening the 30 meter band to the Amateur Service in 1985 it had not included Novices and Technicians in order to promote an acceptable balance between licensing incentives and operating privileges. It followed the same guideline in the opening of the 17 meter band in 1989, the FCC said.

Thus, this petition for rule making was repetitive, the FCC said. *TNX ARRL; FCC; Westlink Report, Number 649, May 13, 1993.*

## Sale of Airwaves Gains Support

A Clinton Administration plan to sell much of the electromagnetic spectrum to the highest bidder as a way of increasing government revenues has gained conditional support from industry and regulatory officials. While some government regulators did caution that any bidding process must provide the smaller business with the ability to compete for this resource, they were generally in agreement that such a sale could help offset the rising federal debt.

Congress is currently considering legislation that would transfer some 200 MHz of government-used spectra to the private sector for the development of emerging technologies like advanced cordless telephones, radio LANs, worldwide paging systems, personal locators and other such devices. The House has already passed its version, while the Senate still has its measure under consideration. Both

versions contain wording that would permit the allocation of some of the frequency bands by auction.

While industry leaders see the transfer of this spectra as a boon to the United States economy, several groups, including the National Association of Broadcasters and the American Radio Relay League, feel that the services they represent should be excluded from any competitive bidding of reallocated spectra because of the services they provide. The ARRL is working toward inclusion of language in the final bill to either protect amateur radio from any reallocation or to provide alternative spectra if any reallocation of ham bands shared with the government takes place. The NAB feels that the television broadcast bands should be excluded because the FCC is aware that applications for these frequencies must be based only on their fitness to serve their local communities. *TNX Westlink Report, Number 646, March 31, 1993.*

## Jury Finds 60 Hz EMF Not Cancer Cause

In a case that has caused considerable interest among radio amateurs nationwide, a jury ruled on April 30th that high voltage power lines which transversed the home of a couple with a nine-month-old daughter did not cause the child's rare kidney tumors.

The debate over the danger of high intensity 60 Hz electromagnetic fields has been going on for well over two decades, with several carcinoma experts suggesting that prolonged exposure to these elevated EMF fields could be the source or trigger for several different medical problems, especially in children and pregnant women.

Fear of these fields has caused warnings to go out for women carrying children to avoid working near high current machinery or even using electric blankets during their earliest months of pregnancy.

Although more than 100 studies have been conducted in the past 20 years on EMF effects on human tissue, no conclusive evidence for a direct link between the high power fields and cancer has been proven, though several of the studies suggest an elevated incidence of certain tumors.

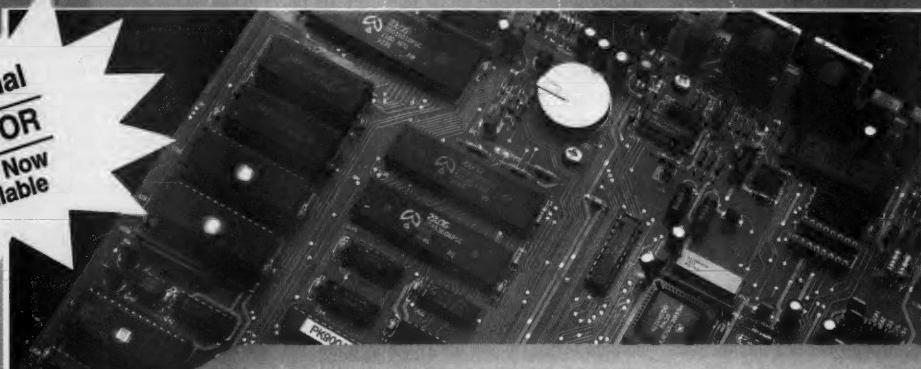
The jury took only four hours to reach its verdict, and although this is believed to be the first case of its kind involving an action against a public power utility, legal observers believe that it won't be the last. *TNX W6RCL; Associated Press; Westlink Report, Number 649, May 13, 1993.*

## TNX . . .

. . . to all our contributors! You can reach us by phone at (603) 924-0058, or by mail at 73 Magazine, Route 202 North, Peterborough NH 03458. Or get in touch with us on CompuServe ppp 70310,775; MCI Mail "WGEPU"; or the 73 BBS at (603) 924-9343 (300-2400 bps), 8 data bits, no parity, one stop bit. News items that don't make it into 73 are often put in our other monthly publication, *Radio Fun*. You can also send news items by FAX at (603) 924-9327. ■

# INTRODUCING THE PK-900... NEW FROM THE INSIDE OUT!

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IT'S THE NEXT GENERATION  
IN MULTI-MODE CONTROLLERS.

Now, there's a new standard of excellence in multi-mode digital controllers...the new PK-900 from AEA. It incorporates all of the features which made the PK-232 the most popular multi-mode controller in the industry. But that's just the start. AEA's new PK-900 also features dual port HF or VHF on either port; low cost 9600 baud plug-in option; memory ARQ and VHF DCD state machine circuit; powerful triple processor system; zero crossing detector for the sharpest Gray Scale FAX you've ever seen; and many other new software selectable features.

Inside and out, the new PK-900 from AEA is what other multi-mode controllers will now be measured against.

- Processors used: Zilog 64180, Motorola 68HC05C4, Motorola 68HC05B4
- Data rates: 45 to 1200 baud standard, up to 19.2K baud with external modems
- Dimensions: 11.75" (29.84cm) x 11.75" (29.84cm) x 3.5" (8.89cm) Weight: 4.6 lbs. (2.08 kg)
- Power requirements: 12 VDC at 1.1 amps

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**AEA**  
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# Type "N" RF Connectors

*How to install and use them.*

by Steve Katz WB2WIK/6

In my article in the May 1993 issue of 73 ("The Hows and Whys of Coaxial Cable," pp. 10-19), I hinted that future articles would supply information on the proper assembly and use of RF connectors. The June issue contains an article on the proper assembly of "UHF" type PL-259 RF connectors for use on the popular coaxial cables. Because the UHF connector assembly is rather complex, its discussion consumed an entire article. Now we can address the installation and application of the *best* RF fitting commonly available for amateur use: the Type N.

Type N connectors are available in a wide variety of designs, all of which should be suitable for use through at least 3,000 MHz (3 GHz), and some which are good right on up through 18 GHz! They are far superior to UHF type PL-259 fittings in many respects, although you probably won't notice any improvement in performance unless you use them at or above 440 MHz (70cm). But even at lower frequencies type N connectors are popular and are often found on commercial and military equipment and antennas intended for use on frequencies as low as 1 MHz. This is because type N fittings cost little more than UHF types and meet military standards for moisture and fungus resistance, which UHF connectors do not.

## Assembly

It makes good sense to learn how to assemble N connectors, especially the standard male type N UG-21. Don't be scared off by

stories you've heard about these rascals being difficult to install—nothing could be further from the truth.

It is true that military grade type N connectors, (at least the solder type, as opposed to the crimp variety), contain more pieces than UHFs. The number of pieces used vary with connector design and manufacturer, but let's concentrate on the most popular type N for amateur use, the UG-21D/U, which has six pieces: (Photo A) the body, the center pin, the braid clamp, the rubber gasket, the rear washer, and the nut. This sounds more complicated than it is, since the *only* piece that requires soldering is the center pin, which solders very fast and easily. Other than this one piece, connector assembly is purely mechanical and requires only two open-end wrenches, a 5/8" for the rear nut and an 11/16" for the connector body.

In addition to the two wrenches you'll also need a few other standard tools for cable preparation: a sharp single-edged razor blade or X-Acto knife; a pair of small, sharp scissors, such as manicure scissors (I use the set contained in my Swiss Army knife, and this works well); and a light-duty soldering gun (75 to 100 watts is fine) with an appropriate tip. Some 60/40 or 63/37 alloy (tin/lead) radio solder with a rosin flux core will also be used. All these things are required for PL-259 UHF connector installation as well, but for a PL-259 you need a *much* larger soldering gun (like 260 watts) because you need to solder the coax braid to the connector body,

which is *not* required with a type N.

Assuming you are using RG8/U-sized cable (RG8/U; RG8A/U; RG213/U, etc., all of which are 0.405" nominal outside diameter), prepare the cable end as follows:

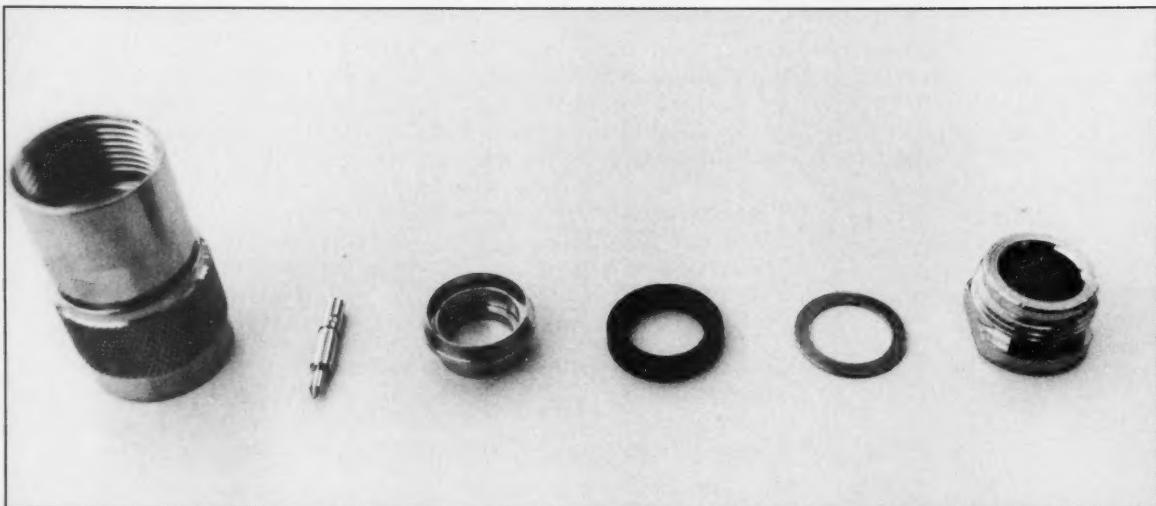
- Slide the type N rear nut onto the cable before proceeding with any other operation. The nut threads should face the end of the cable where the new connector will be installed, and the 5/8" (across the "flats") wrench part should face away from the connector, toward the balance of the cable. Slide this down the cable at least several inches to get it out of the way of your work.

- Next, slide the flat washer (5/8" o.d., and about 7/16" i.d.) onto the cable, over the jacket, so that it will be located between the rear nut and the connector body. The washer has no "polarity."

- Now, slide the rubber gasket onto the cable, also over the jacket, so that the *grooved* side of the gasket faces the cable end, and the flat, smooth side is towards the washer you just installed in step 2.

- How long did this all take? Probably about five seconds. Push the three parts already on the cable far enough out of the way so they won't interfere with the rest of your work—you won't be needing them until the very last step when you tighten the connector together.

- Now you are ready to strip the cable (Photo B). Use the razor blade or X-Acto knife to cut into the cable, applying enough pressure to cut through the outer jacket, braid



*Photo A. Here are the six pieces that make up a standard UG21D/U type N connector (left to right): the body, the center pin (note the gold plating), the braid clamp, the rubber gasket, the washer, and the nut.*

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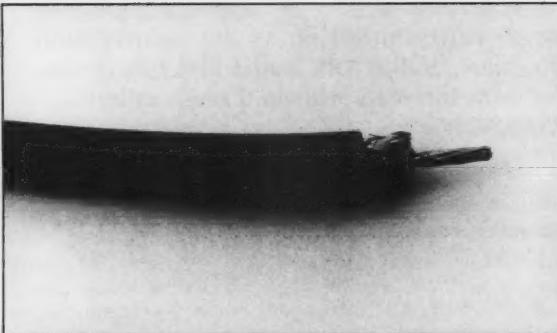


Photo B. The end of a piece of RG213/U, all stripped and ready for pin and connector installation. (Not shown are the rear nut, flat washer and rubber gasket installed in steps 1, 2, and 3.) Note that the center conductor strands are tightly twisted and no braid "hairs" extend beyond the dielectric.

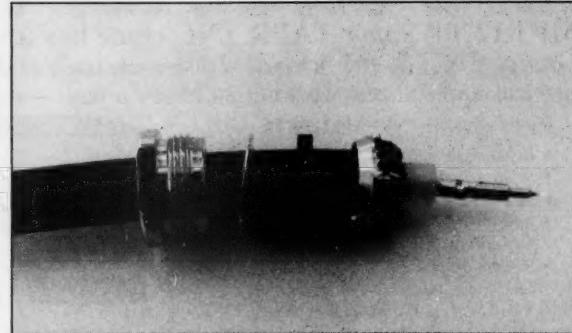


Photo C. Here, the center pin has been neatly soldered on so that solder completely fills the solder hole in the pin. The braid is pulled back over the dull edge of the braid clamp and the gasket, washer and nut are ready to assemble into the connector body.

and dielectric insulation material all at once. Stop when you "hit" the center conductor. Make this cut exactly  $5/16$ " back from the cable end. It is easy to tell, with a bit of practice, how much pressure to apply to cut cleanly through all the layers without nicking or damaging the center conductor. The outer jacket will produce almost no resistance to cutting; the braid will produce considerable resistance, but a few "saws" with the knife and you'll be through it. Then the dielectric will produce some moderate resistance, but not a lot. When you cut through these layers and reach the center conductor, it is obviously much harder than the dielectric, and as soon as you feel its resistance, stop. If you find that you've nicked the copper center conductor even a little bit, cut off the damaged end of the cable and try again. It won't take long before you're an expert at this.

Once you've cut through to the center conductor (but stopped short of nicking it), hold the blade against the cable with the same steady pressure and rotate the cable 360 degrees to cut all the way around it. When you're done, you should be able to give a gentle pull on the end of the cable to completely remove the stripped section and reveal  $5/16$ " of nice, shiny, undamaged center conductor. With practice, this operation takes about 15 seconds.

6. (For steps 6 through 10, please refer to Photo C.) Now, use the razor blade or X-Aceto knife to make a cut in the cable's outer jacket *only*,  $3/16$ " down from the end you cut off in step 5. The outer jacket will cut easily—don't apply enough pressure to cut into the braid. If you damage the braid you'll have to start all over, so be careful. Apply very gentle pressure and rotate the cable 360 degrees until you've made a shallow cut all the way around. When you feel the slightest resistance from the copper braid *stop*—you've cut far enough. Pull off the  $3/16$ " of jacket material, exposing this much undamaged braid.

7. Push the open end of the type N center pin onto the cable's center conductor. If you're using stranded-conductor cable (and I

hope you are—it's much more flexible and easier to work with in the long run), be sure that no strands are separated from the bundle before attempting to push the center pin over it. If any strands are separated, gently twist them back together, making sure to twist *in the same direction* as the conductors were originally stranded by the manufacturer. The center pin should "bottom out" on the tip of the center conductor, with the open end of the center pin laying flat against the cable's dielectric. If this is *not* the case, and the pin "bottoms out" with more center conductor still showing between the pin and the dielectric, you need to cut a bit more off the center conductor length. Look to see how much center conductor shows between the end of the pin and the dielectric; pull the pin back off, and cut off that amount of center conductor. Now, push the pin back on. It should bottom out on the center conductor and rest against the dielectric with no extra center conductor showing. Again, this step could take a bit of practice, but after you've installed a few connectors it will take only a few seconds.

8. Lay the end of the cable, with the pin installed, on a flat working surface and place a gentle weight (like a heavy book) on the cable about  $4\text{--}6$ " back from the end of the cable. Twist the center pin until the soldering hole shows on *top*, so you can get at it easily. Apply heat from your soldering iron or gun to the pin, near the hole, and wait a few seconds for the heat to transfer. Applying a *small* amount of solder between the pin and the tip of the iron will make this heat transfer go much faster.

When the pin has reached soldering heat (this shouldn't take more than five or six seconds), apply solder directly to the hole in the pin. After it flows, continue to push a bit of solder into the hole to be sure it "wets" to the cable's center conductor. Don't use too much solder or it will be difficult to get the excess off the outside of the pin (and this will be necessary to complete connector installation and use). Take the iron and solder away, and wait about 10 seconds for the pin to cool off.

Blowing gently on the pin will accelerate this process. When the pin has cooled down so that it's not too hot to touch, pull on it gently to be sure it is well attached to the center conductor. If it pulls off, the solder didn't "take," indicating either not enough soldering heat, not enough solder, or an oxidized center conductor. If the center conductor looks bright and shiny, it's not oxidized. If it has a dull or oxidized appearance, there's something wrong with this piece of cable and it probably shouldn't be used anyway. Try again, and with practice you'll find the pin and conductor will "wet" very well and the pin will be impossible to pull off with your hands.

9. Assuming the pin is properly soldered, inspect the outside of the pin to see if excess solder has flowed onto it. Excess is any amount that causes a "bump" in the diameter

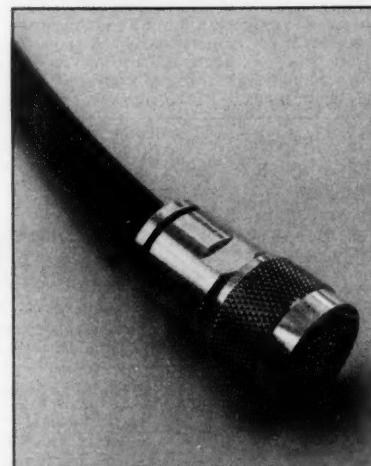


Photo D. The completed, installed type N connector. When the rear nut was tightened a very small space remained between the nut and the connector body. This is perfectly normal. Using high-quality, open-end wrenches for final assembly avoids scratching or nicking the connector plating and leaves a shiny, weatherproof surface.

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of the pin. A thousandth of an inch of solder is not a problem, but ten thousandths probably is. If excess solder is on the pin, use a very fine grit emery cloth or very fine nail file (not a large machinist's file or rasp!) to gently file it away. You don't want to file away at the center pin's original plating, which is likely to be a very fine layer of gold. Again, with practice there won't be any excess solder anyway.

10. Slide the braid clamp over the end of the cable, with the smaller-diameter end towards the connector pin already installed, and the larger-diameter end, which should be beveled and have a rather sharp edge, towards the bulk of the cable, rubber gasket, washer and rear nut already installed in steps 1 through 3. Gently fold the braid back over the metal braid clamp until all of it is folded neatly against the 3/16" shaft of the clamp. If you trimmed the jacket correctly in step 6, the braid will end before the beveled part of the braid clamp. If you cut off too much jacket, braid "hairs" will extend over the beveled portion of the clamp, and this is no good. Some hams just "trim away" any extra braid at this point, but this defeats the purpose of using a type N connector: If the braid is too long, that means too much jacket has been removed, which also means too much dielectric will now be exposed between the clamp and the pin. This will ruin the geometry of the installation, make "seating" the connector

difficult, and defeat the purpose of using such excellent "constant impedance" connectors. If you made a mistake, it's better to chalk it up to experience and start over with step 5.

11. You are now done with all the critical operations. All that is left is to screw the connector together. Push the connector body over the pin and onto the cable, with the threads "first," towards the bulk of the cable. If no excess solder is present on the pin this should happen quite easily. You might meet with just a little resistance as the pin inserts itself into the Teflon dielectric of the connector body, but a bit of a "push," and it will be on. This will place the braid clamp fully inside the connector body as well, as you will see. When you've pushed the body onto the cable, and all steps have been done properly, the tip of the center pin should be about "flush" with the end of the connector, and the rear end of the braid clamp will be fully inserted inside the body, now recessed about 3/16". If this doesn't happen, you didn't follow some instruction. Think it out, and try again.

12. Slide the rubber gasket down to the connector end of the cable until it seats itself on the rear (beveled, sharp) end of the braid clamp. These two pieces are designed to "mate," and the beveled end of the braid clamp will end up inside the rubber gasket. If you're thinking that the braid clamp will cut

the rubber gasket in half when the connector is fully tightened on, you're correct: This is part of the design.

13. Now, slide the flat washer down to the rubber gasket so that it rests against the flat side of the gasket and is fully inside the connector body.

14. Slide the rear nut down to the connector body until it mates with the body's threads, and gently twist the nut clockwise to screw it into the connector body. After four or five twists you should begin to feel some resistance to further threading. Now is the time to get out those two open-end wrenches! Use the 5/8" wrench on the rear nut, and a thin 11/16" wrench on the "flats" of the connector body (a "fat" or "thick" wrench usually won't fit—there is only about 3/16" space here for the end of the wrench). Hold the body firmly while threading the nut into it until you meet considerable resistance to further threading. At this point, the rear nut should either be "bottomed out" right against the connector body, or close to it, with a very small space showing between the nut and the body. You're done! (See Photo D)

Although this took a lot of description, complete installation of the UG21D/U type N male connector takes only about two to three minutes for the beginner, and far less time for an experienced technician. When I worked in an engineering lab many years ago I'd take an entire day about once or twice a year just

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to build type N "patch" cables for the lab, and could usually assemble 50 or 75 such cables per day, with two connectors per cable. This is a lot of connectors, considering I'd take lots of breaks to avoid total boredom.

To test your completed connector assembly and installation, hold the connector firmly in one hand, grab the cable about six inches away in the other hand, and give the cable a firm pull. You should *not* be able to pull the connector off the cable. In fact, even 50 pounds of tension will not pull off a properly installed type N because the braid clamp has amazing strength. You might also want to use an ohmmeter to check for the possibility of a short circuit between the pin and body of the connector, but if you've followed directions, this is *extremely* unlikely.

#### Caveats

If you use *foam* dielectric cable (any brand) or Belden 9913 type cable, do *not* expect the standard UG21D/U center pin to fit the center conductor! Foam cables and 9913 both use "oversized" center conductors (due to the lower dielectric constant of the insulation material used) which is larger in diameter than standard RG8A/U or RG213/U military types, and will not fit the standard pin dimension. Thankfully, special type N connectors are available for these non-standard cables. They are often sold as UG21-9913 or some such nomenclature to indicate they are

supplied with an oversized pin specifically to accommodate the special cables.

If you use double-shielded cable like RG9/U or RG214/U, the braid may *not* fit in a standard UG21/U braid clamp/body assembly. These specialty cables also have special connectors made just to suit them. (Frankly, unless you are using the cables to interconnect repeater duplexer cavities, I can't imagine why you'd want to use double-shielded cable. It is not any better in any respect than single-shielded cable, with the sole exception of its reduced RF leakage property. Single-shielded cable like RG213/U has low enough leakage for 99.9% of amateur applications.)

There are varieties of type N connectors which are more complex and contain more pieces than the UG21D/U type described here. For the most part, they aren't any better, except possibly at the high end of the SHF spectrum (above 6 GHz) and therefore might best be avoided. Conversely, there are some excellent type N "crimp on" connectors which require no soldering at all and are thus even easier to install than the one described here. The problem is, some of these cost far more and require specialized and expensive tools for their installation. A good, standard type N UG21D/U connector that will install exactly as described here and is of high enough quality for the vast majority of amateur applications is the Amphenol "RFX" series, part number 82-202-RFX. This six piece

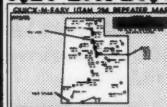
connector, as I've described, is bright nickel-plated for excellent resistance to weathering, and is relatively inexpensive, averaging around twice the price of a cheap UHF type PL-259.

One more note: Yes, type N connectors are available for practically every type of coaxial cable, from subminiature RG174/U to "water-hose" sized RG17A/U. The connectors intended for use with smaller cables (RG174/U, RG58/U, RG59/U, RG8X, etc.) have a smaller rear nut, washer, gasket and braid clamp and a smaller hole in the center pin, but otherwise install as described. The connectors intended for use with larger cables (RG17/U, RG217/U, RG18/U, etc.) have a larger body and rear nut, washer, gasket and braid clamp, and a larger hole in the center pin, but still install as described. If you practice with a piece of military standard RG213/U you'll learn enough to know how to install *any* of the type N varieties on any cable type.

Once you get the hang of it, installing a type N fitting is as easy as falling off a log and much less painful. The type N has lower loss than a UHF type PL-259, especially in the upper VHF and UHF spectrum (300 MHz and above), is more weather-resistant, handles more RF voltage, and will fit more high-end commercial and military equipment and antennas. If you *don't* get familiar with using them, you're missing the boat.

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# Mobile CW Operation

*Ham radio's oldest mode keeps rolling.*

by Steve Katz WB2WIK/M6

**W**ait a minute, what's that again? Who would want to operate mobile CW?

I do, for one, and I'm finding a growing number of mobile CW enthusiasts on the HF bands who must agree with me that it's great fun and more productive than mobile phone (SSB) operating. CW is our oldest mode of amateur radio communications, and enjoys an 80-plus-year history of hundreds of thousands of operators and many millions of successful contacts made. Yes, it's old-fashioned, but CW is hard to beat for making contacts with minimal equipment and antennas. Because of its narrow bandwidth and smallest-possible consumed spectrum, CW is an efficient mode of communications. The "newer" digital modes, like RTTY, AMTOR and packet are a bit faster and more automated, but all require specialized equipment that cannot always be managed for field, portable or mobile operations.

Mobile operations, besides being fun and a great way to pass the time while stuck in traffic, lends itself beautifully to CW work. How does one drive a vehicle and send CW at the same time? Easily! How do you drive and talk into a microphone at the same time? It's almost the same thing, and while most

mobile phone operators have had at least one experience where the mike cord got entangled in the steering wheel or knocked over a cup of coffee sitting on the dashboard, a properly laid-out mobile CW station will never encounter these difficulties! How does one concentrate on driving and copy CW at the same time? Easily! Of course, you must copy "in your head," and not be reliant on pencil and paper, lest your mobile CW operations become deadly hazardous.

Based on my several years' experience in operating mobile CW, I have developed a few ground rules by which newcomers to the art must reasonably try to abide:

1. It helps to be a good CW operator to start with. Sloppy sending or poor copying ability will make mobile CW work nearly impossible. Practice at home for as long as it takes to become proficient in CW work, and wait until you start receiving unsolicited compliments on your "fist" before attempting mobile CW work.

2. It helps to have small, uncomplicated equipment. While a new TS-450S might make a good mobile rig, it has too many knobs and buttons, which might be a distraction. I'd stick with simple, inexpensive, sol-

id-state (and no-tune) rigs. My latest acquisition for mobile CW work is the new MFJ model MFJ-9020, a 20 meter (only) CW (only) transceiver which occupies less space than the average 2 meter FM rig, weighs almost nothing, mounts anywhere, and has a list price of only \$179 (I got mine for \$169, brand-new). See Photo A. This little rig works incredibly well and has only four front-panel controls, one of which is the ON/OFF switch! Who needs S-meters, output level meters, dual VFO's, memories and so forth while they're driving 60 mph on the freeway? Surely not I.

3. Permanently mount your keyer paddle in the most convenient and comfortable place possible. I have mine, an MFJ 442B-X (electronic keyer and Bencher paddle in one small box), attached to my center console between the two front seats of my car, between the gearshift handle and the parking brake handle—a nearly perfect spot, at a reasonable height to make sending very comfortable. See Photo B. Route all wires and cables so they're not in the way at all, and are preferably hidden from view altogether. (I have mine "tucked away" under various parts of the console cover materials.)



*Photo A. The little MFJ QRP-CW rig will mount just about anywhere, and is so light that a plastic dash will hold it just fine. I used an old bracket from a Radio Shack CB rig (or something), modified slightly for the MFJ rig.*



*Photo B. The MFJ/Bencher keyer/paddle combination works well and is mounted with Velcro™ to the center console between the front seats of my car. Convenient, handy, unobtrusive and just the right height for easy keying while mobile!*

# FEEDBACK

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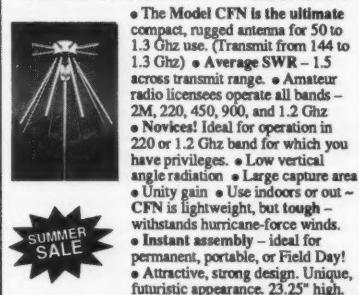
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73 Amateur Radio Today • July, 1993 17

4. Use an external speaker for the receiver, preferably one that can face directly at you. I use an amplified speaker to help overcome road noise: a great deal from Radio Shack, model 21-541. This speaker, which requires a source of 12 VDC power as well as audio drive, produces 8 watts of undistorted audio, sounds great, and costs about \$25.

5. Since mobile stations must use compromise antennas due to space limitations, use the best mobile antenna you can find (whether it be purchased or home-brewed). I use a Hustler™ fold-over mast with screw-on resonator/whip assemblies, mounted on a heavy-duty "ball" (3/8"-24 thread) on the rear fender of my station wagon, with the ball height 32" above the road surface. The antenna, with the 20 meter resonator/whip installed, is 86" long and 62" of its length is completely above the roof line of the vehicle. It works so well that I often can't believe it! I've worked about 45 states and 70 countries with this system so far (in the past few months). There are many mobile HF antennas on the market, and most of them will work well if properly installed.

6. If you like DX, stick with the higher HF bands (20 through 10 meters). Conditions are better and the antennas are more efficient, and cover greater bandwidth, than ones for 30-40-80 meters. (Although 30 meters, being a digital-mode-only band with enforced power restrictions, might be kind of fun from the car—I haven't tried it yet.) Twenty meters is probably "open" more hours per day, and more days per year, than any other band, but 17 and 15 meters aren't too far behind, and 12-10 meters can be great daytime bands in the winter months. Over the last two winters (1990 and 1991), using a Radio Shack HTX-100 10 meter 25W rig and an 8' long "CB" whip (cost: \$9.95), I worked mobile CW DXCC.

7. If you *really* like DX, try a mobile power amplifier! I use a home-brewed one (shown in the photograph) which cost about \$60 to build and uses a pair of MRF247's to develop 100W output power with less than 5W drive across the HF spectrum, 3-30 MHz. This amp was a cinch to build and is essentially identical to the Communications Concepts, Inc. (Beavercreek, Ohio) model EB-63, which sells for \$89.95 in kit form, without cabinet or heat sink. My little amp sits tucked away in the corner of the trunk, just a few inches from the antenna base. (See Photo C.)

8. Answer CQs on an active band; only call CQ when the band's nearly dead. No matter what you run, your mobile signal will not compete very well with base-stations using higher power and efficient antennas. (However, I have been able to work weak DX stations right through enormous pile-ups when I've been parked at advantageous locations. Using 100W and my mobile whip, while parked on a good mountaintop with a clear horizon in all directions, has done better for me sometimes than my legal-limit station at home. Driving or parking along an



Photo C. The trunk compartment with the hatch door removed. The 12 VDC cooling fan is mounted to the hatch cover and blows directly on the mobile amp's heat sink, which is normally just a few inches below the fan when the hatch is closed. The amp can be seen to the right.

ocean beach isn't bad, either.)

9. Be sure to make your own vehicle as free of ignition noise in the RF spectrum as possible. You can't control other vehicles on the road, but almost any motor vehicle can be improved in this area. Simply using resistor-type spark plugs and shielded ignition wiring, regularly replaced when worn, goes a long way towards minimizing ignition noise. My Volvo wagon, factory-equipped, happens to be a very low-noise vehicle, but many aren't.

10. Lastly, when using long or top-heavy mobile antennas (as many are) it often pays to "guy" them a bit to prevent damage from high-speed driving. My Hustler 20 meter whip would place too much strain on any conventional ball mount when traveling at high speeds (let's not discuss *how* high) if it weren't secured with a piece of string to the roof rack of my car.

So much for suggestions. How are mobile CW contacts made? No sweat! Same as home-station CW contacts. You either answer someone else's CQ, call CQ yourself, or break into a CW QSO if it sounds interesting. Your mobile rig will *have* to have some sort of break-in capability (full QSK or "semi-QSK," which is usually the same as VOX on SSB) so you only need to touch the paddle to send. After just a bit of practice you'll be having long CW rag-chews with the best of us. Operating mobile phone or CW is all the same—if you can't chew gum and walk at the same time, mobile operation on any mode is not for you. But if you've had no problem with VHF-FM mobile work, then CW HF mobile work is not any more difficult, provided you're a proficient CW operator to begin with.

Personally, I *like* CW. It's very relaxing to me, and easier to listen to for long periods than phone. Probably the great narrow-band-

width CW filters that allow only one signal to pass to the speaker have a lot to do with this. You can't use a 500 Hz filter on SSB, but on CW it's the norm. Even my little MFJ-9020 has a factory-standard narrow CW filter (with an even narrower one available as an option) which, for the most part, is narrow enough to allow receipt of just one signal at a time, even during crowded conditions. While headphones make CW operation even easier at home, I'd not recommend them for mobile work: They're illegal to use while driving in most states, and might restrict your ability to hear emergency sirens or horns honking. As with any mobile work, the task of controlling your vehicle must take priority over a QSO. Occasionally you might need to forget about your QSO and make an emergency maneuver—just do it, and forget about the QSO. Your contact will probably still be there after the emergency is over, but if not, so what? There will always be another contact.

I guess in addition to being a proficient CW operator, it pays to be a good driver! I'd not recommend mobile CW work (or maybe mobile work of any kind) for brand-new drivers who are still learning the ropes, or for nervous drivers who consider the task of keeping their car on the road an enormous job that requires 100% concentration and then some. But for those of us who drive comfortably in all kinds of conditions, and those who, like me, log 50,000 miles per year on the roads with zero accidents, mobile CW operation should be as easy as falling off a log. And speaking of logs, don't forget to keep one in your glove compartment to record all the great DX you're going to work!

Hope to hear you on the CW bands. For now, this is WB2WIK/M6 (mobile, 6th call area) QRZ DX?



## 73 Review

by David R. Corsiglia WA6TWF

# The AEA HamLink Model HL-60

*Does your radio miss you when you're not home?*

Did you work late and miss your sched, again? Did you miss that rare DX contact that waited for you to get to work before transmitting? Do you want to let your friends try out your rig without the hassle of throwing a party? Well, now there's a solution for these problems and more: HamLink—the interface between your telephone and ham radio. It allows remote operation of your HF, VHF, or UHF transceiver. Any time you're near a Touch-Tone phone you can control your radio almost as if you were home.

The TWF Super System, a 15-repeater (440 and 1.2) membership group, recently installed a HamLink. We are certainly enjoying giving it a workout!

Our members were already comfortable with the idea, because they regularly use our three remote base repeaters by operating HF radios remotely using the DTMF tones on their 440 transceivers. But now, with HamLink installed, they're able to work HF even from work or from friends' and relatives' homes. For the first time, remote CW! With a speaker phone, it's easy to share the fun.

Club members and elmers can make HF stations available to other hams this way. We found the unit's voice announcement of frequency and mode worked great for sight-impaired members.

The HamLink can be interfaced with receivers and transceivers which are computer controllable (although no computer is required). The interface cable between HamLink and the radio is specific to the radio's manufacturer and can either be purchased or home-brewed from the wiring diagrams and parts lists in the manual. We installed our unit on a Kenwood TS-940S.

Installation was simple and the instructions were clear and easy to follow. The four cables that make up the interface are for the computer port and external speaker (all compatible radios) and the jacks for the CW key and microphone (transceivers only). The other connections are for power (either AC or 12 VDC) and, after initialization, the telephone line. Initialization consists of introducing your radio to HamLink, entering the security code, and setting the telephone answer mode.

The telephone can be answered after a spe-

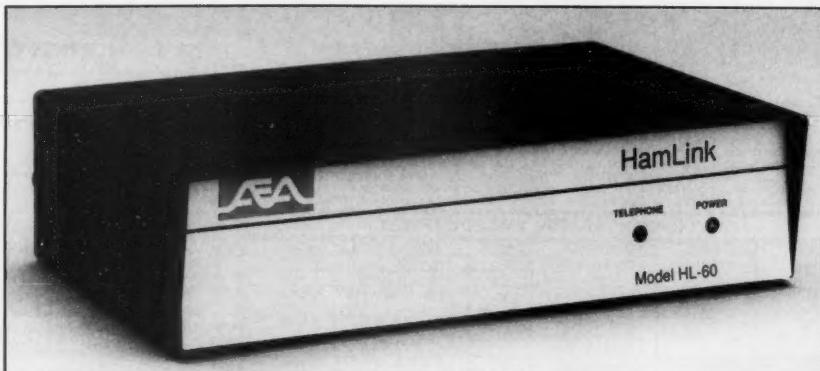


Photo A. The AEA HamLink Model HL-60.

cific number of rings or, if HamLink shares the phone line with an answering machine or fax, it can be set to answer immediately after a hang-up and call-back. The telephone answer mode can be changed remotely as well.

We can call HamLink with any Touch-Tone phone. After entering the security code, there we are—listening to the band according to the frequency and mode we were last on. We can easily change to whatever frequency our radio is capable of receiving.

This means that, depending on the radio, you could listen to any frequency: the AM broadcast band, WWV, shortwave broadcast band, 2 meter FM, 20 meter upper sideband, etc. The radio can be tuned to a specific frequency or pulsed up or down in 10 Hz, 100 Hz, 1 kHz, or 5 kHz increments. With a little practice you will easily be able to tune in all the modes, including sideband signals.

When you have tuned in a station and you are ready to transmit, depress the "\*" Touch-Tone button; from then on you will be transmitting. When you are done transmitting, depress the "\*" button again to put the radio back into receive.

You may also select either of the two VFOs or the radio's memory mode. Then you can select different memories or scan the memories. You can request the frequency the radio is on at any time and the interface will reply with a "human voice" telling you the exact information. You may also inquire about the mode, such as USB, LSB, AM, narrow FM, wide FM, CW, and RTTY, (although HamLink is not recommended

for RTTY use.)

You can even send CW through the HamLink via a Touch-Tone button on your phone. You may not achieve great speed, but it might just be good enough to grab that rare country that you have been seeking that only comes around while you are at work.

The AEA Hamlink is very small (8" x 5" x 2") and only weighs three pounds. The unit is not polarity sensitive, so if you accidentally hook the power up incorrectly you will not smell smoke! The unit draws only 200 mA. So, with a 12 volt DC powered transceiver, it could be used for emergency communication in an earthquake or flood.

You can also plug a cordless phone base into the RJ11 jack inside HamLink, then just carry your cordless handset around your home to operate your transceiver.

A sightless and otherwise handicapped operator may find it especially advantageous to use a cordless phone as a control unit.

### Hardware Requirements

In some cases you may need an additional computer interface board. These accessories can be ordered from the manufacturer. As of this date, the following radios and computer interfaces will work with the ARE-60:

- All ICOMs that have a CI-V computer port.
- The ICOM 751A has a CI-V port and requires a UX-14 adapter to convert it to the required CI-V bus.
- Yaesu FT-890, FT-990, FT-1000, FT-747GX, and FT-757GX2. The Yaesu do not require an



additional computer interface.

Any Kenwood radio with an active computer port will work, but some radios need interfaces: The Kenwood TS-440 and R-5000 require an IC-10; the TS-711 and TS-811 require an IF-10A; the TS-940S requires an IF-10B; the TS-140 and TS-680 require an IF-10C; the TS-690, TS-450, TS-850 and TS-950 don't require an interface; the TS-50 requires an IF-10D.

Please note: More radios are being added to this list.

These computer interface boards are usually installed inside the radio. Not all dealers have the boards in stock so it is a good idea to get them on order at the same time that you order HamLink.

One of the best things about the ARE-60 is the ease of installation and setup. It took exactly 17 minutes from the time I opened the box to my first on-the-air contact.

I highly recommend that you order the optional cable kit for the radio you are going to use. It's inexpensive and very well-made. You merely plug in the cables from HamLink to the radio and from a Touch-Tone telephone to a RJ-11 connector inside HamLink.

You program HamLink with any standard Touch-Tone phone, inputting the type of radio you are using, as described in the very-well-thought-out operating manual. Then unplug the phone and connect a phone line to the RJ-11 phone jack on the rear of HamLink. You're ready to start having fun. That's all there is to it!

Our club gave HamLink a thorough workout. We set up a unit at our Orange County Super Station, where we have a full-size three-element 80 meter beam, six-element KLM tribander and a full-size 40 meter beam. To test for RFI we used an Alpha 87A running the legal limit. At a special club meeting we gave out copies of instructions for HamLink, along with the security code and phone number. For the next couple of weeks there were many phone

calls by members trying out the system and making contacts. The Touch-Tone codes are very straight-forward and there was very little problem in getting the members of the club up to speed.

They were able to use some of HamLink's auxiliary functions to switch antennas when needed. They found absolutely no RFI and everyone commented on the superb audio on both receive and transmit. In fact, the stations that were contacted via HamLink most of the time had no idea that we were operating remote via telephone.

All comments from members who tried HamLink were positive and most of them wanted to install a full-time dedicated station using it.

One of the neat things about HamLink is that you can listen to any frequency that the

transceiver is capable off. Many of the club members are also shortwave listeners and particularly liked tuning in a shortwave broadcast station, then using the 5KHZ step feature to step their way up and down through the shortwave broadcast band.

The only negative thing I could find with HamLink is that if you are not careful you could accidentally transmit out-of-band. You have to check the frequency announcement often as you are tuning around to make sure that you did not hit an out-of-band frequency by mistake.

HamLink does everything as advertised, and at \$269 it's a great bargain.

Contact David R. Corsiglia at 858 Lenz Drive, Anaheim CA 92805; telephone: (704) 535-5528; Fax: (714) 520-9087.



Frank felt that a 25 minute dissertation on canning okra was appropriate repeater traffic during the rush hour snow storm.

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- RIPLE Less than 5mv peak to peak (full load & low line)
- All units available in 220 VAC input voltage (except for SL-11A)

MODEL	Colors Gray	Colors Black	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
• LOW PROFILE POWER SUPPLY						
SL-11A	*	*	7	11	2 1/4 x 7 1/2 x 9 1/4	11

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
• POWER SUPPLIES WITH BUILT IN CIGARETTE LIGHTER RECEPTACLE				
RS-4L	3	4	3 1/2 x 6 1/2 x 7 1/4	6
RS-5L	4	5	3 1/2 x 6 1/2 x 7 1/4	7

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RM-12A	9	12	5 1/4 x 19 x 8 1/4	16
RM-35A	25	35	5 1/4 x 19 x 12 1/2	38
RM-50A	37	50	5 1/4 x 19 x 12 1/2	50
RM-60A	50	55	7 x 19 x 12 1/2	60
• Separate Volt and Amp Meters				
RM-12M	9	12	5 1/4 x 19 x 8 1/4	16
RM-35M	25	35	5 1/4 x 19 x 12 1/2	38
RM-50M	37	50	5 1/4 x 19 x 12 1/2	50
RM-60M	50	55	7 x 19 x 12 1/2	60

MODEL	Colors Gray	Colors Black	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-3A	*	*	2.5	3	3 x 4 1/2 x 5 1/4	4
RS-4A	*	*	3	4	3 3/4 x 6 1/2 x 9	5
RS-5A	*	*	4	5	3 1/2 x 6 1/2 x 7 1/4	7
RS-7A	*	*	5	7	3 3/4 x 6 1/2 x 9	9
RS-7B	*	*	5	7	4 x 7 1/2 x 10 1/4	10
RS-10A	*	*	7.5	10	4 x 7 1/2 x 10 1/4	11
RS-12A	*	*	9	12	4 1/2 x 8 x 9	13
RS-12B	*	*	9	12	4 x 7 1/2 x 10 1/4	13
RS-20A	*	*	16	20	5 x 9 x 10 1/2	18
RS-35A	*	*	25	35	5 x 11 x 11	27
RS-50A	*	*	37	50	6 x 13 1/4 x 11	46

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
• Switchable volt and Amp meter				
RS-12M	9	12	4 1/2 x 8 x 9	13
• Separate volt and Amp meters				
RS-20M	16	20	5 x 9 x 10 1/2	18
RS-35M	25	35	5 x 11 x 11	27
RS-50M	37	50	6 x 13 1/4 x 11	46

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
• Separate Volt and Amp Meters • Output Voltage adjustable from 2-15 volts • Current limit adjustable from 1.5 amps to Full Load				
VS-12M	9	5	4 1/2 x 8 x 9	13
VS-20M	16	9	5 x 9 x 10 1/2	20
VS-35M	25	15	5 x 11 x 11	29
VS-50M	37	22	6 x 13 1/4 x 11	46
• Variable rack mount power supplies				
VRM-35M	25	15	5 1/4 x 19 x 12 1/2	38
VRM-50M	37	22	5 1/4 x 19 x 12 1/2	50

MODEL	Colors Gray	Colors Black	Continuous Duty (Amps)	ICS* Amps	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-7S	*	*	5	7	4 x 7 1/2 x 10 1/4	10
RS-10S	*	*	7.5	10	4 x 7 1/2 x 10 1/4	12
RS-12S	*	*	9	12	4 1/2 x 8 x 9	13
RS-20S	*	*	16	20	5 x 9 x 10 1/2	18

by Michael Bryce WB8VGE

# The Hewlett Packard HP 34401A Digital Multimeter

*Add a top quality test instrument to your workbench.*

I know several hams who will spend thousands of dollars on the newest rig this year but who don't own a useful digital multimeter. I don't have money to drop on new gear, but I do require a digital multimeter I can count on. I spend much more time at the workbench than at the operating table.

After going through a pile of off-brand digital multimeters, I decided that I needed something better than what the local Radio Shack carried. So, last year at the Dayton Hamvention, I started to look for a new bench-style digital multimeter.

My wife and I happened to stop in front of the Hewlett Packard booth. I took a quick look, told my wife that "HP" means "high price," and started walking away. Then an HP salesperson walked up to us and started talking.

What he showed me changed my mind about HP. The HP 34401A is a 6-1/2 digit, high performance digital multimeter in a bench-top style case. The HP 34401A does so many things that calling it a mere digital multimeter doesn't do it justice.

## Features Abound

The HP 34401A has a highly visible vacuum-fluorescent display. It also has built-in math operations such as Min-Max, Null Value, High Limit, Low Limit, dB REL, etc., as well as continuity and diode test functions. The "hold" feature lets you make hands-free readings. How about an auto trigger set to take a specific reading at a certain time interval? The HP 34401A will even tell you how many times it's been calibrated!

You can set the resolution from 4-1/2 to 6-1/2 digits. You can turn off the autorange feature and use manual control. Two- or four-wire resistance checks make reading low resistance values easy. You can measure frequency up to 300 kHz as well.

Other features of the HP 34401A include an HP-IP (IEEE-488) interface and an RS-232 interface, both standard. You can program the HP 34401A with standard programming languages such as SCPI, HP 3478A and Fluke 8840. You may also use the HP 34401A in a remote interface setup. You can even set it up as a "go/no go" tester.

A front panel switch selects either the front test probes or the rear probes (a set of test probes comes with it). There are so many features that it's hard to keep track of them all.

## Putting the HP 34401A to Use

Hewlett Packard includes two manuals with the HP 34401A. One is the user's guide and the other is a service manual. The manuals are super! They're easy to read, and you can find what you're looking for without digging through layers and layers of material.

Each HP 34401A comes from the factory with its own specifications and a certificate of calibration sheet. You know the amount of error on each range on almost every function. The DMM goes through about 100 separate tests before passing final calibration. You can have the HP 34401A calibrated to MIL-STD-45662A specs if you desire for an extra charge. You may also send the HP 34401A back to Hewlett Packard at any time to be re-calibrated for about \$90.



Photo A. The Hewlett Packard HP 34401A digital multimeter.

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Model	Pin	Pout	Ic	Gain/NF	(13.8 V)	Type
<b>50 MHz</b>						
0503G	1-5	10-50	6	15/0.6	LPA	
0508G	1	170	28	15/0.6	Standard	
0508R	1	170	28	-	Repeater	
0510G	10	170	25	15/0.6	Standard	
0510R	10	170	25	-	Repeater	
0550G	5-10	375	60	15/0.6	HPA	
0550RH	5-10	375	60	-	Repeater HPA	
0552G	25-40	375	55	15/0.6	HPA	
0552RH	25-40	375	55	-	Repeater HPA	
<b>144 MHz</b>						
1403G	1-5	10-50	6	15/0.6	LPA	
1406G	25	100	12	15/0.6	Standard	
1409G	2	150	25	15/0.6	Standard	
1409R	2	150	24	-	Repeater	
1410G	10	160	25	15/0.6	Standard	
1410R	10	160	24	-	Repeater	
1412G	25-45	160	20	15/0.6	Standard	
1412R	25-45	160	19	-	Repeater	
1450G	5	350	56	15/0.6	HPA	
1450RH	5	350	56	-	Repeater HPA	
1452G	25	350	50	15/0.6	HPA	
1452RH	25	350	50	-	Repeater HPA	
1454G	50-100	350	40	15/0.6	HPA	
1454RH	50-100	350	40	-	Repeater HPA	
<b>220 MHz</b>						
2203G	1-5	10-40	6	14/0.7	LPA	
2210G	10	130	20	14/0.7	Standard	
2210R	10	130	19	-	Repeater	
2212G	30	130	16	14/0.7	Standard	
2212R	30	130	15	-	Repeater	
2250G	5	220	40	14/0.7	HPA	
2250RH	5	250	40	-	Repeater HPA	
2252G	25	220	36	14/0.7	HPA	
2252RH	25	250	36	-	Repeater HPA	
2254G	75	220	32	14/0.7	HPA	
2254RH	75	250	32	-	Repeater HPA	
<b>440 MHz</b>						
4403G	1-5	7-25	4	12/1.1	LPA	
4410G	10	100	19	12/1.1	Standard	
4410R	10	100	18	-	Repeater	
4412G	20-30	100	19	12/1.1	Standard	
4412R	20-30	100	18	-	Repeater	
4448G	5	100	22	12/1.1	HPA	
4448R	5	100	22	-	Repeater HPA	
4450G	5-10	175	34	12/1.1	HPA	
4450RE	5-10	175	34	-	Repeater HPA	
4452G	25	175	29	12/1.1	HPA	
4452RE	25	175	29	-	Repeater HPA	
4454G	75	175	25	12/1.1	HPA	
4454RE	75	175	25	-	Repeater HPA	



All amplifiers (non-rpt) are linear, all-mode with fully automatic T/R switching and PTT capability. The receive preamps use GaAs FET devices rated at 5 dB NF with +18 dBm 3rd order IP. LPA, Standard and HPA amps are intermittent duty design suitable for base and mobile operation. Repeater amps are continuous duty, class C.

**Amplifier capabilities:** High-power, narrow or wideband; 100-200 MHz, 225-400 MHz, 1-2 GHz, Military (28V), Commercial, etc. - consult factory. A complete line of Rx preamps also available.

## RX Preamplifiers

Band	Model	NF	Gain	Connector
		(dB)	(dB)	Connector
50 MHz	0520B	.5	25	BNC
50 MHz	0520N	.5	25	N
144 MHz	1420B	.5	24	BNC
144 MHz	1420N	.5	24	N
220 MHz	2220B	.5	22	BNC
220 MHz	2220N	.5	22	N
440 MHz	4420B	.5	18	GNC
440 MHz	4420N	.5	18	N
1.2 GHz	1020B	.9	14	BNC
1.2 GHz	1020N	.9	14	N

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Each time you turn on the meter it does a quick self-test. You can do a more extensive test by holding down the "SHIFT" button when turning on the power. The HP 34401A will respond with a "PASS" on the digital readout.

Of course, the most common things we do with a digital multimeter is to measure voltage, current, and resistance. The HP 34401A excels in these areas. The HP 34401A measures voltage in the following ranges: 100mV, 1V, 10V, 100V, 1,000V (750 VAC). Maximum resolution is 10 nV on the 100 mV range. AC voltage is true RMS and AC-coupled. The HP 34401A will measure current from 10 mA to 3 amps.

Resistance ranges from 100 ohms to 100 megohms. Maximum resolution is 100 micro ohms on the 100 ohm range. The HP 34401A utilized either a two- or four-wire resistance measurement system. For normal resistance checks, the two-wire system works just like any other digital multimeter. But for low, low resistance checks, you'll get the best results with the four-wire method. By using the second set of test leads, you reduce the amount of resistance between the digital multimeter and the resistor you're trying to measure.

The HP 34401A uses a menu system to access sub-menus from the front panel. This is discussed in a very straightforward manner in the user's guide. There are plenty of diagrams to help you navigate the menus in the

user's guide. All you have to do is follow the prompts on the display to access the menu system. It's much easier to do than to explain, but the HP user's guide does an excellent job.

Operation is straightforward and very simple. Just select the function you desire and you're off and running. The autoranging is as fast as any I've seen. You don't have to wait for this meter to keep up with you.

There are several relays inside that you can hear switching on and off as the HP 34401A selects the proper range. After awhile I got used to the clicking and found that I could use the relays as an audio feedback when the meter would switch ranges. Let's say you're looking at the output of a voltage divider and it should be 7 volts. If you're busy flipping the switch on the rig you're testing, it's hard to keep an eye on the HP 34401A display. But, if you hear the HP 34401A flip a relay, you know your test point went over 10 volts. That's where the relays switch over.

I'm hell on digital multimeters. I always forget to switch from resistance before going to volts or current to frequency. The HP 34401A is very forgiving. I've only had to replace the current fuse twice and both times it's been because of operator error.

#### The Bottom Line

I love it! When the service manual says

the mixer should have 0.1785 volts on the emitter, the HP 34401A will let me know. No more guessing, no more wondering if the test meter is accurate, no more hassle with service personnel telling me my test meter is wrong.

I had some trouble with the local power company with low line voltage. I told the service person I had low line voltage. I was then asked how I knew the voltage was low. Was I using a department store meter? No! I'm using an HP 34401A by Hewlett Packard. Two hours later a repair truck arrived and found the problem.

Is there anything I don't like about the HP 34401A? Well, there is one little item—the marketing. Hewlett Packard says that the HP 34401A is their "low end" instrument. I don't like spending \$1,000 and then being told that I got a "low end" product. Their new "within budget, without compromise" is better.

I would have liked to have had a higher current rating: up to 10 amps instead of only 3 amps. You can add an external high current shunt for taking high current readings if you want.

Yes, it does cost a thousand dollars. But think about that for a second. Would you want to have someone fix your \$2,600 rig with a \$24 meter? This is a case where you really get what you pay for.

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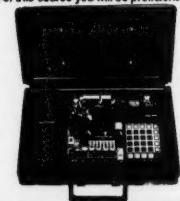
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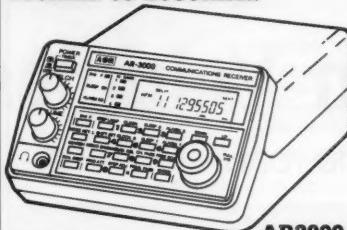
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by Gene Beaver W4PVI

In the summer of 1982, Dot (MYL) and I decided that we were going to take a year's tour of the country in our 22' Mini-Motorhome. I most certainly was going to operate the HF bands, but I didn't want to be confined to a mobile antenna all that year.

Installation of an antenna on the roof was impractical due to the height involved because the antenna would not clear low hanging trees, bridges, etc. A quick-connect

would mean climbing the ladder each time it was used. Not very convenient!

I had a Hustler SBT Vertical on hand. To solve my problem I only had to figure out how to haul this tall antenna and how to make it quick and easy to put up and take down each time it was used.

I had been a member of the RV Service Net for a couple of years, and knew Chuck W8UCG (SK) (the originator of the Uni-Strut antenna mount on Airstream trailers). I decided to adapt the mount to my motor home.

#### Construction

After taking some measurements, I realized that if the Uni-Strut was used and the antenna base was to be about 12 inches above the roof, I would have to do an awful lot of climbing up and down the motor home's ladder in order to complete the installation and then do the required tuning. That didn't appeal to me at all. I had to find

a way to swivel the mount as well as fold it over.

The answer came out of the plumber's shop, where I obtained the following materials:

- 1 length of 1" galvanized water pipe
- 1 length of 1/2" water pipe
- 2 1/2" end caps
- 1 1/2" female coupler
- 1 1" female tee joint
- 1 1" floor flange
- 1 1" el (female one end, male the other)

I cut the 1" pipe into three lengths—one 97", one 18", and one 9"—and threaded on all ends. (The 97" length was required for installation on my present Allegro motor home and most likely will have to be changed for your rig.)

The floor flange was fitted to one end of the 97" length and the el to the other. Then I attached the center of the tee joint to the el. I tightened the last two joints snugly, then

*Continued on page 31*



Photo A. Close-up of the antenna mount.



Photo B. Close-up of the tie-down rope attachment.



Photo C. Working on the antenna is easy—just swivel and tilt.

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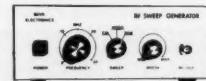
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## Tilt-Over Swivel Antenna

Continued from page 28

backed off half a turn. These are the points that allow the antenna to be raised and lowered and to be swiveled from side to side.

Next, I fastened the 18" length to the top of the tee and the 9" length to the other end.

The 63" length of 1/2" pipe (threaded at both ends) was passed up through the 18" length pipe, the tee joint and the 9" pipe. An end cap was installed on the top. The 1/2" coupler and a 3" length of 1/2" pipe were attached to the bottom.

Then I slid a heavy-duty key ring (yes, like a car key ring) over the bottom end of the 1/2" pipe, installed the other end cap, and attached a 6-foot length of 3/8" nylon cord to the key ring.

The entire assembly was set up vertically, with the floor flange resting on the rear bumper to which it was attached with counter-sunk screws.

The bumper now supports the weight of the mast and the antenna when attached.

### Installation

The 97" pipe is attached to the roof ladder, approximately 60 inches up from the bumper. This provides the lateral stability. If it is not convenient to support the mast at the ladder, a suitable two-point brace can be used at a point on the RV where screws are already in place.

Once the mast is in place, and the antenna is in the "up" position, the 1/2" "handle" should be attached to the ladder or some other support.

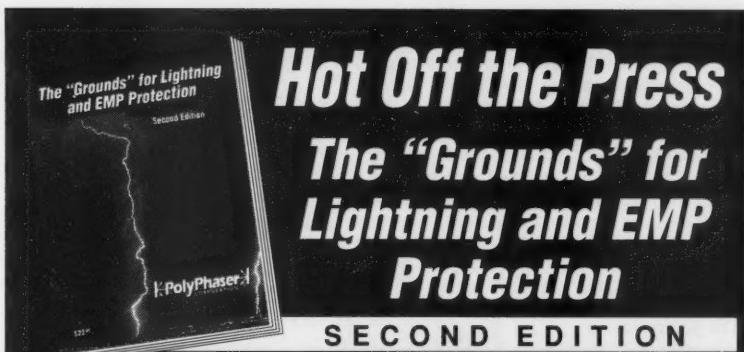
You will be able to come up with your own method of securing the handle when the antenna is in the up position. This is necessary to assure that the antenna stays in the vertical position when operating.

Next, I installed the antenna on the 18" pipe. The antenna bracket was installed as high as the U-bolts would allow, to prevent the mounting pipe from interfering with the radiation pattern.

The antenna can now be lowered by holding the handle and the nylon cord. Once the antenna is in the horizontal position, the handle can be slid forward with the cord and fastened to prevent sliding back during travel.

The advantages of the "sliding handle" are obvious when observing the rear overhang of the handle before being slid forward. When lowering the antenna for travel, slide the 1/2" pipe forward and secure with the rope. Reverse the procedure for raising. You will need to install some kind of cradle on the roof for the antenna to ride in while underway.

I installed only the bracket and first antenna section while working on the roof. Once that portion was complete, the mast was folded and swiveled so that the antenna rested on a chair that was on the ground. All remaining work and tuning was done without once having to climb atop the motor home.



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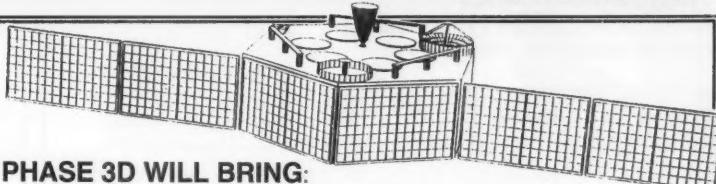


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CIRCLE 110 ON READER SERVICE CARD

## Make Sure It's Grounded

While this is not a technical article, there are three things that are very necessary to an efficiently operating mobile antenna of this type: ground, ground and ground.

I use 1/2" copper braid from the antenna base to the "closest possible point" to the roof or ladder in several places, and then down the ladder to the vehicle chassis. I do the same from my radio to the chassis.

Do the very best job you can with grounding during installation and forestall any future problems from that source.

## The Safety Factor

Everyone needs to adhere to standard safety practices when working atop anything with ladders, etc. Be especially careful when raising the antenna. I personally know two hams who have raised their antenna into a power line. No harm came to either, but one had a "real hot" trailer for a while. IT COULD HAVE BEEN FATAL! ALWAYS LOOK UP BEFORE RAISING THE ANTENNA.

It's easier than you think to drive off and leave the antenna in the air. Most of the time you won't get out of the RV park before disaster strikes. A tree or a power line will get you. I know one friend who stopped at a fast-food joint for lunch, put up the antenna to check into a net, and then drove off. He got five miles down the Interstate before leaving his 75 meter coil on top of the bridge and the rest scattered all over the highway.

I had a sign made with two words: ANTENNA DOWN? I attach it to the steering wheel and gear selector as soon as I stop.



Photo D. Pull the 1/2" pipe all the way out with the rope, then pull down to raise the antenna. Tie off the rope to secure.

The two things I wanted most from this tilt-over/swivel mount were versatility and convenience. I got both. I put the clock on myself once when pulling into a rest stop and wanting to check into the RV net. I started the clock when I put the gear selec-

tor in park, went to the rear of the motor home and raised the antenna, got back in the driver's seat, keyed the rig and stopped the clock. Time elapsed: 30 seconds.

The next thing I did was to hang my "ANTENNA DOWN?" sign.

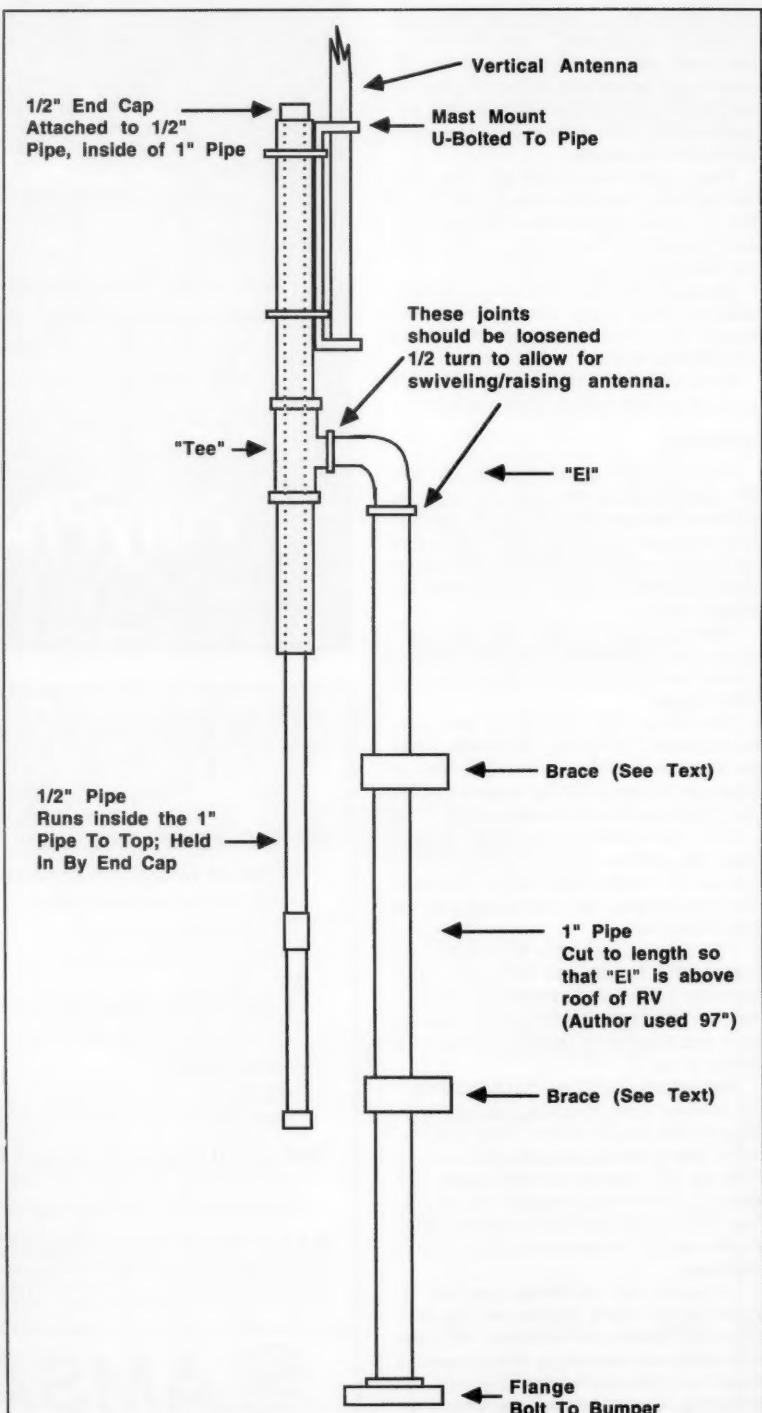


Figure 1. Construction details of the RV antenna mount.

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Length: 17' 8"  
Connector: SO-239



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Dual-Band: 146/446MHz  
Gain & Wave:  
146MHz 6.5dB 5/8 wave x 2  
446MHz 9.0dB 5/8 wave x 5  
Max Power: 200 watts  
Length: 10' 2"  
Connector: SO-239



#### CA-2xFX

Dual-Band: 146/446MHz  
Gain:  
146MHz 4.5dB  
446MHz 7.2dB  
Max Power: 200 watts  
Length: 5' 11"  
Connector: SO-239

### COMET™ DUAL-BAND MOBILE



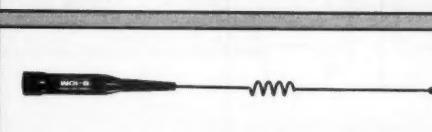
#### CA-2xMB

Dual-Band: 146/446MHz  
Gain & Wave:  
146MHz 4.5dB 7/8 wave  
446MHz 7.0dB 5/8 wave x 3  
Max Power: 150 watts  
Length: 4' 10"  
Connector: PL-259



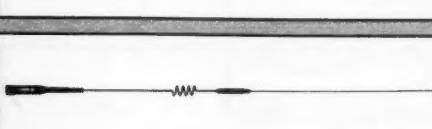
#### CA-2xSR

Dual-Band: 146/446MHz  
Gain & Wave:  
146MHz 3.8dB 5/8 wave  
446MHz 6.2dB 5/8 wave x 2  
Max Power: 150 watts  
Length: 3' 4"  
Connector: PL-259



#### B-10B-10NMO

Dual-Band: 146/446MHz  
Gain & Wave:  
146MHz -dB 1/4 wave  
446MHz 2.15dB 1/2 wave  
Max Power: 50 watts  
Length: 12"  
Connector: PL-259 or NMO Style



#### B-20B-20NMO

Dual-Band: 146/446MHz  
Gain & Wave:  
146MHz 2.15dB 1/2 wave  
446MHz 5.0dB 5/8 wave x 2  
Max Power: 50 watts  
Length: 20'  
Connector: PL-259 or NMO Style

### COMET™ SINGLE-BAND MOBILE



#### CHL-151

2 Meter Mobile Antenna  
Gain & Wave:  
4.1dB 5/8 wave  
Max Power: 200 watts  
Length: 4' 8"  
Connector: PL-259

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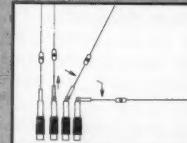


#### CH-32

Miracle Baby 146/446MHz HT  
Gain & Wave: 0dB  
Max Power: 10 watts  
Length: 1.75'  
Connector: BNC



SH-55  
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SUPER Flexible  
HT Antenna  
Gain & Wave:  
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# Expanded Range Direct-Reading Inductance Meter

*Build this cheap choke checker.*

by Arthur C. Erdman W8VWX

The inductance meter I described in the January 1992 issue of *73 Amateur Radio Today* works well but it is limited to about 10 to 250  $\mu\text{H}$ . The basic circuit creates a pulse, the width of which is directly proportional to inductance. A digital voltmeter (DVM) reads the average value of the pulse train. Readers have inquired about how to extend the range to lower and higher values. Much thought and experimentation provided an answer: Place the unknown inductance in series with a known inductance. This avoids having the circuit inductance approach zero at the low end of any scale. Also, the range of linearity is narrowed, making the circuit quite practical.

As a specific example, I used a fixed 10  $\mu\text{H}$  inductance on the "0" to 25  $\mu\text{H}$  range. Now the circuit sees 10 to 35  $\mu\text{H}$ .

The pulses never get vanishingly narrow. Insert a 100  $\mu\text{H}$  for the 0 to 250  $\mu\text{H}$  range and, finally, use a 1,000  $\mu\text{H}$  for the 0 to

2,500  $\mu\text{H}$  range. See Figure 1.

These inductors (5% tolerance) are available for less than \$1 each from Mouser Elec-

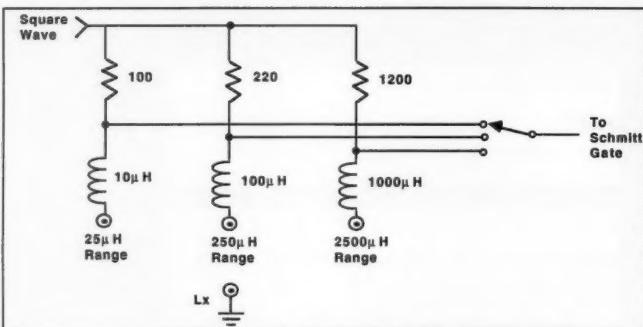


Figure 1. Basic measuring scheme.

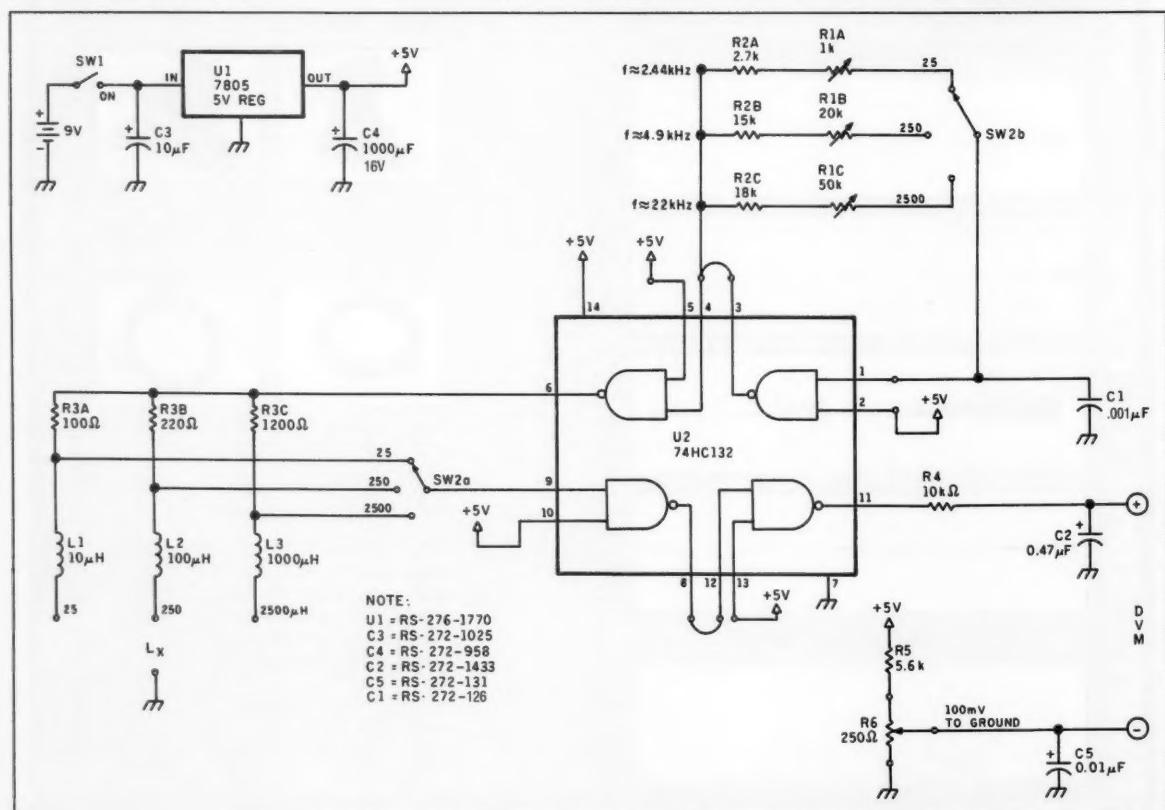


Figure 2. Schematic for the expanded-scale direct-reading linear inductance meter.



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Been quite a showdown of late 'twixn the Kenwood TS-950SX, Icom IC-781 and Yaseau FT-1000D. Waitin' in the wings to gun down the winner is that new Stranger in Town — the Kenwood TS-50S. Each packs a "six-shooter" (160-10) trying to gun down the competition. Also they's got a full General Coverage Receiver (If dat don't beat all!).

Of course, the old timers (Used Equipment) still hold their own against those younger rustlers offering many of the same dad-burn features of the younger fellas but not requiring the shackles!

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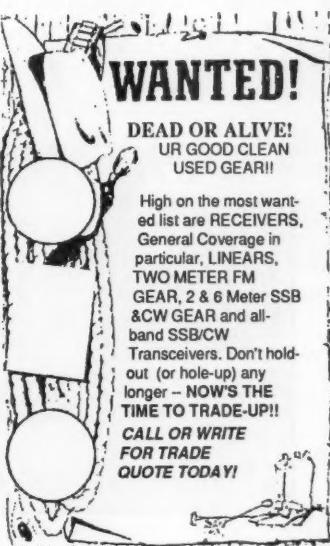
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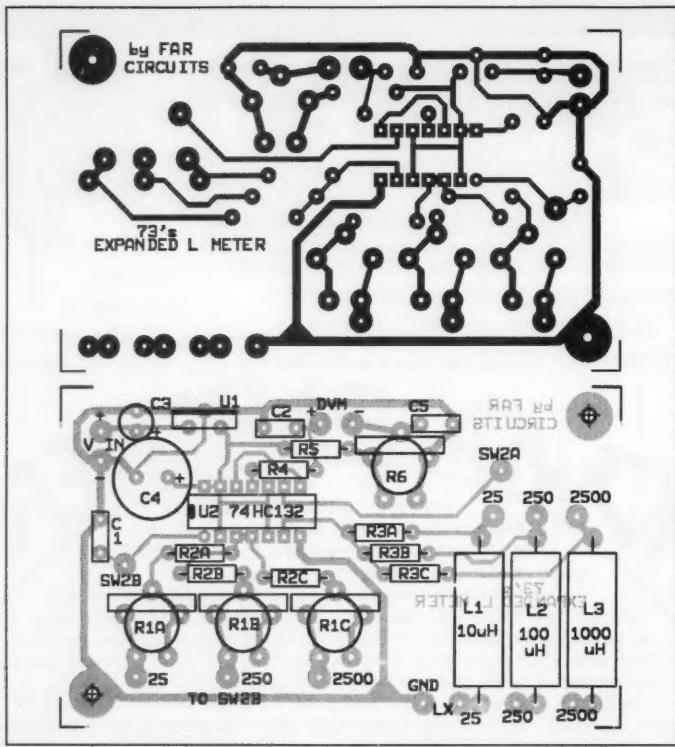


Figure 3. PC board pattern and parts placement for the expanded-scale direct-reading linear inductance meter.

tronics. The offset voltage due to this method of measurement is simply counteracted by a bucking voltage.

Linearity is excellent because the greatest change in pulse width on any range is only 3.5 to 1. Without the series inductance, the linearity must be over a much greater range. For example, without the series inductance, the "0" to 250  $\mu$ H range would never reach "0" because the pulse would be too short to pass through the gates. If 10 to 250 is readable, the linearity must be over a 25 to 1 range.

The following indicates the scale resolution:

1) 0 to 25  $\mu$ H; 10 mV/1  $\mu$ H

2) 0 to 250  $\mu$ H; 1 mV/1  $\mu$ H  
 3) 0 to 2,500  $\mu$ H; 1 mV/10  $\mu$ H

Circuit limitations prevent the 0 to 2,500  $\mu$ H range from having greater sensitivity. Figure 2 indicates the complete circuit.

#### Construction

To avoid switching of the critical inductances, I elected to have a separate jack for each range. I am always trying out different circuits (and values) so I seldom use a printed circuit. The most convenient approach that I've found is to use an "experimenter's plug-in board." Radio Shack carries these. They are listed as "Solderless IC Breadboards." I used their board, catalog number

276-175, approximately 2" x 3-1/2", with 270 connecting points. Number 22 wire fits snugly into the holes. So do 1/4 watt resistor leads, most capacitor leads and best of all, integrated circuit legs.

Drilled and etched PC boards are available for \$4.25 plus \$1.50 S&H from FAR Circuits, 18N640 Field Ct., Dundee IL 60118.

#### Tune-Up

(The L meter and DVM power supplies cannot be both AC line powered or the bucking voltage will be shorted out due to common grounds.)

1. Adjust the bucking voltage to 100 mV. To do this, connect the DVM from the read-out negative terminal to ground (chassis).

2. On each range, short the  $L_x$  terminal to ground and adjust the proper pot for 0 volts at the read-out terminals. That's all that is required.

If you discover that inserting a known inductor in the circuit produces a slight error on the read-out, remember that your standard is only within 5%. Coils in the 250 to 2500  $\mu$ H range have widely varying DC resistance, causing linearity errors. Iron core coils read truer due to less wire resistance than air core coils of equal inductance.

#### Parts List

R1A	1k ohm pot
R1B	20k ohm pot
R1C	50k ohm pot
R2A	2.7k ohm
R2B	15k ohm
R2C	18k ohm
R3A	100 ohm
R3B	220 ohm
R3C	1200 ohm
R4	10k ohm
R5	5.6k ohm
R6	250 ohm pot
C1	0.001 $\mu$ F
C2	0.47 $\mu$ F
C3	10 $\mu$ F
C4	1000 $\mu$ F 16V
C5	0.01 $\mu$ F
U1	7805
U2	74HC132
L1	10 $\mu$ H choke
L2	100 $\mu$ H choke
L3	1000 $\mu$ H choke

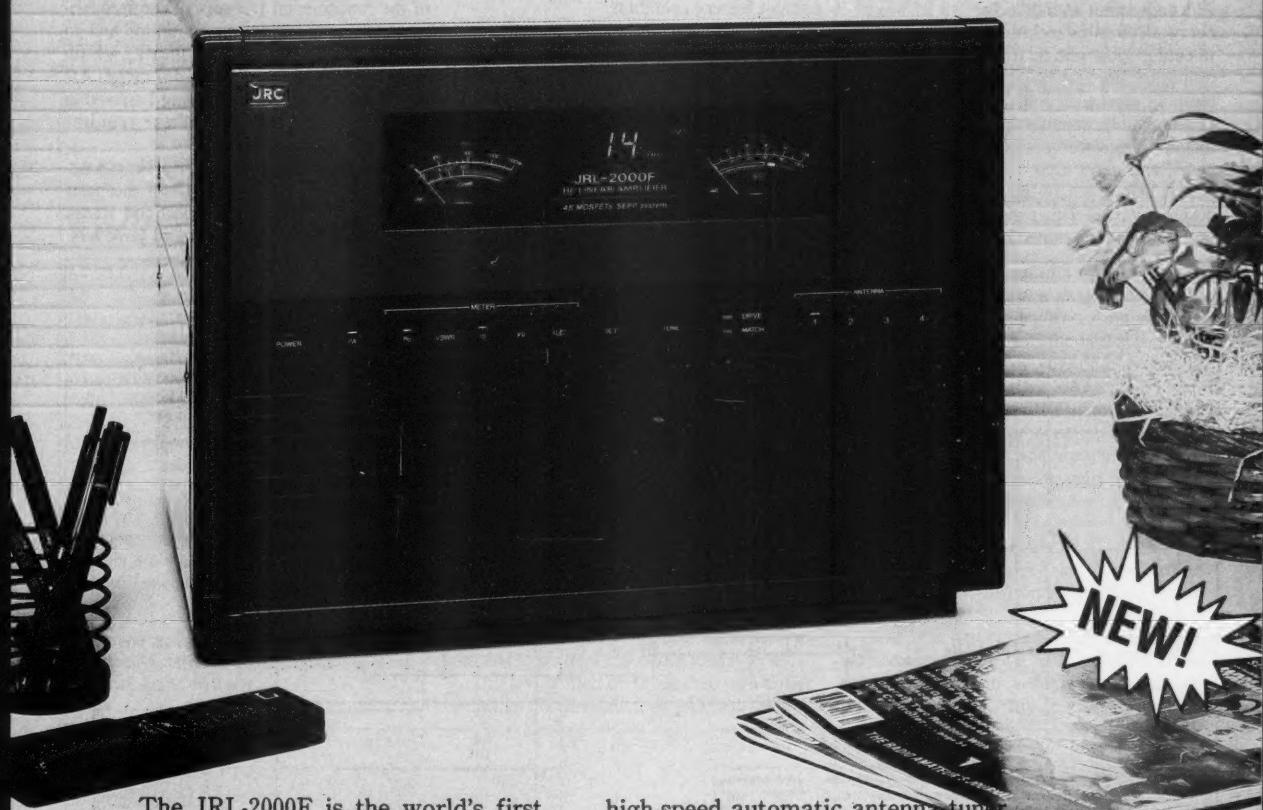
RS272-126  
 RS272-1433  
 RS272-1025  
 RS272-958  
 RS272-131  
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CIRCLE 159 ON READER SERVICE CARD

# Deluxe Function Generator

*This simple project has many uses.*

by David Cripe KC3ZQ

A function generator is one piece of equipment found in the lab of nearly every electronics technician and engineer. In conjunction with an oscilloscope, a function generator can be used to test or troubleshoot most gear found in the hamshack. Unfortunately, commercial function generators are priced well out of the range of most hams, and good used ones don't often appear at hamfests. Consequently, I decided to design my own! This simple, low-cost function generator features TTL, square-wave,

triangle, and sine-wave outputs, and portable battery operation.

## Design

I started out by defining the features I wanted. This project had to be low-cost, using commonly available parts. It had to be portable, operating from batteries. It needed to have a TTL output for testing logic circuits, as well as variable-amplitude square, triangle, and sine-wave outputs. The sine wave output must be relatively pure, with

the amplitude of the harmonics less than 1% of the fundamental frequency. The frequency range of the function generator had to cover 100 hertz to 10 kilohertz, which would include most of the audio range. After a few hours of breadboarding I arrived at a circuit which met all of these requirements.

See Figure 1. This is a fairly simple design using only three ICs. All of the parts are available at your neighborhood Radio Shack, or from any well-stocked junk box.

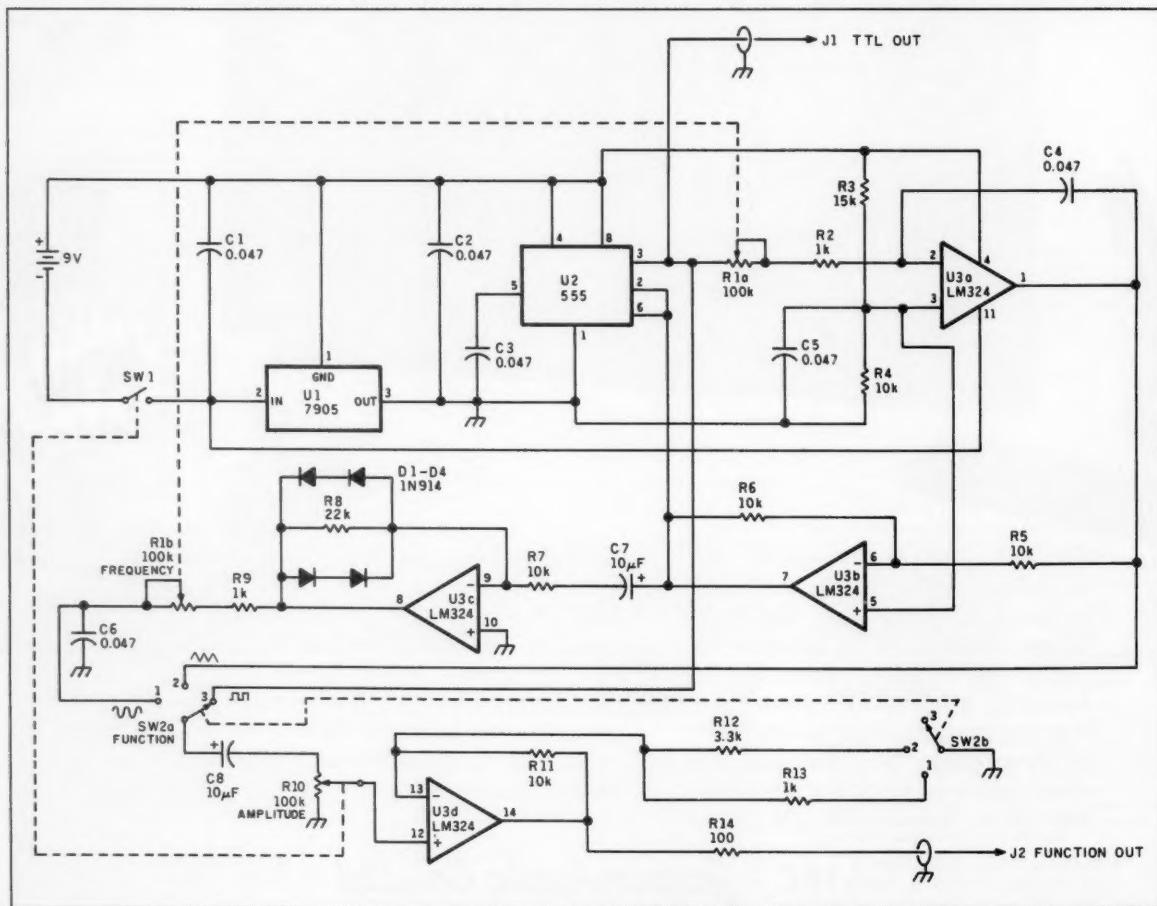


Figure 1. Schematic for the Deluxe Function Generator.

The circuit can be built conveniently on one of Radio Shack's solder-pad breadboards, such as their part #276-168, or you can purchase an etched and drilled PC board from FAR Circuits, 18N640 Field Court, Dundee IL 60118 (\$4.50 plus \$1.50 S&H).

After mounting the circuit in a folded aluminum box, I found its small size and portability made it easier to use than any of the commercial function generators I was familiar with. I actually ended up taking it to work with me to use at my job for those applications where portability is preferred over accuracy. I am now building my second one!

The heart of the function generator is a U2, a 555 timer. These ICs are tremendously useful devices, with high-current outputs, capable of driving TTL loads. It is configured as a somewhat unconventional square-wave oscillator in this circuit. The square-wave output of U2, pin 3 of the 555, is integrated by U3a, one section of an LM324

quad op amp, producing a highly accurate triangle wave. This waveform is then buffered and inverted in U3b, and fed back into pins 2 and 6 of the 555, its trigger and threshold inputs, respectively. This causes U2 to produce its square-wave oscillation. The frequency of oscillation is determined by R1a, one section of a 100k stereo volume control pot.

We now have a circuit which generates a square wave and a triangle wave. Obtaining a sine wave is a bit more difficult. Those of us who had a little math in college may remember some theorems from a fellow named Fourier, telling us that if we take a sine wave and add its third, fifth, seventh, ninth, etc., harmonics at the correct levels, we come up with a triangle wave. Conversely, low-pass filtering the harmonic components from a

triangle wave should leave us with a sine wave. It turns out that if we clip the upper and lower 33.3% off of the peaks of a triangle wave the resultant trapezoidal waveform contains no third harmonic energy. Passing this waveform through a simple, one-pole low-pass filter gives us a sine-wave of sufficient purity for our needs. Diodes D1 through D4 perform the function of waveform clipping in U3c. The low-pass filter consists of R9, R1b (the second section of the 100k stereo volume control pot), and C7. Since the cutoff frequency of this filter, controlled by R1b, tracks the oscillator frequency, the sine wave output of has a nearly constant amplitude over its frequency range. This sine-wave is very pure, with no harmonic higher than 1% of the fundamental.

The last section of U3 is used as a buffer amplifier for the function generator output.

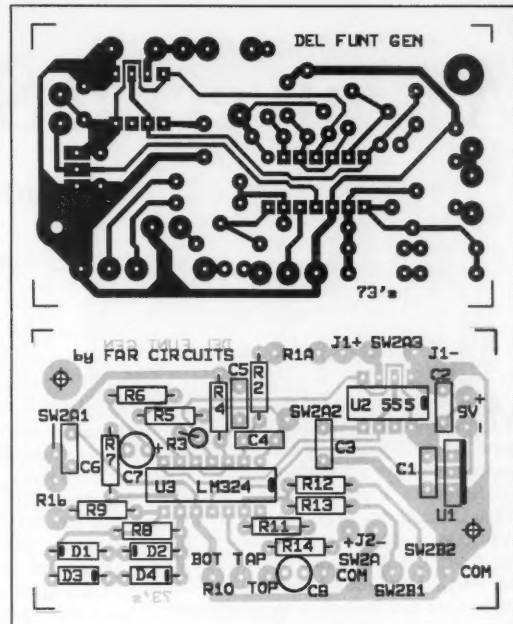


Figure 2. PC board pattern and parts placement.

Switch SW2a, one section of a two-pole, three- (or more) position switch, is used to select the square, triangle, or sine wave to be buffered. The gain of the buffer is set by R10, a 100k log taper volume control pot. The circuit on/off switch SW1 may be integrated into R10. Since the amplitude of the square, triangle, and sine waveforms at SW2a are not equal, the second section of SW2 is used to scale the gain of the U3d buffer so that the amplitudes of the three waveforms are roughly equal at the output.

A 7905 voltage regulator, U1, creates a stable 5 volt source for the 555, as well as the split (+5, -4 volt) supply required by the op amp.

Give this project a try. I can think of worse ways to spend a rainy weekend afternoon than building a simple, inexpensive project that has as many uses as this one.

### Parts List

C1-C6	0.047 $\mu$ F	272-134
C7,C8	10 $\mu$ F	272-1025
R1	100k stereo volume	271-1723
R2,R9,R13	1k, 1/4W	271-1321
R3	15k, 1/4W	271-1337
R4-R7,R11	10k, 1/4W	271-1335
R8	22k, 1/4W	271-1339
R10	100k audio pot	271-1772
R12	3.3k, 1/4W	271-1328
R14	100 ohm, 1/4W	271-1311
D1-4	1N914, 1N4148 etc.	276-1122
SW1	SPST pot switch	271-1740
SW2	2-pole, 6-position	275-1386
U1	7905 -5V regulator	See Note 1
U2	555 timer	276-1723
U3	LM324 quad op amp	276-1711

Note 1: The 7905 regulator is not normally stocked by Radio Shack, although it can often be found in their "Regulator Assortment" 276-1660. It's also generally stocked by most mail order houses.

Drilled and etched PC boards are available from FAR Circuits, 18N640 Field Ct., Dundee IL 60118 for \$4.50 plus \$1.50 S & H.

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CIRCLE 293 ON READER SERVICE CARD

# A Universal Speech Processor

*An easy upgrade for your transceiver.*

by Bob Roehrig K9EUI

**M**ost of the more expensive HF transceivers today have some form of speech processing. Less expensive rigs have either marginally effective processors or none at all.

Older radios, especially tube-type units such as Drake, Swan, and Collins, do not have any processing at all. Over-modulation protection, if any, is accomplished by means of an ALC circuit. Many hams (believing that ALC is to be used as a form of compression) drive their units well up into the ALC region on the meter. Some rigs that have ALC have no means to monitor its operation. ALC is intended only to protect from over-modulation on occasional peaks. The ALC indicator should just barely show action once in awhile. An ALC circuit is not a substitute for a speech processor.

Unless you have a fancy "high-end" rig with a decent internal processor, it is well worth the time to construct an outboard unit. QRP enthusiasts who operate SSB can get the most out of a low power rig with the use of an effective processor.

## Construction

The unit described here is an easily-assembled processor that can be used with any rig available today. Its small size even makes it possible to install the unit inside some rigs, rather than in a separate box.

I chose to build my processor in a mini-box so it could be used on several rigs. (I also plan to add a keyer circuit for CW in the same box.) The circuit was assembled on a small piece of "hobby board" from Radio Shack. A drilled and etched PC board for this project is available for \$4.25 plus \$1.50 S&H from FAR Circuits, 18N640 Field Ct., Dundee IL 60118.

The input circuit of the processor consists of an op amp with a voltage gain of 10 and has an input impedance of 100k. This should accommodate almost any type of microphone in use. The output of this stage is adjusted by R5.

Diodes D1 and D2 rectify the audio signal. The DC voltages are filtered by C3 and C4. These capacitors also determine the time constant of the circuit. The voltage from the rectifiers is applied to diodes D3 and D4 to for-

ward bias them. These diodes act as variable impedance devices. The higher the voltage applied to them, the more they "turn on," shunting more of the audio signal to ground.

Capacitors C5, C6 and C7 isolate the DC levels from the audio portion of the circuit.

The output amplifier performs two functions: It has a gain of 10 to make up for losses in the processor part of the circuit, and also transforms the relatively high impedance of the processor to a lower impedance so the processor cannot be loaded down. R13 is the output level adjustment.

Power decoupling is accomplished by R14 and C9. R1 and R2 form a voltage divider to properly bias the op amp inputs at half the supply voltage. The supply voltage is not critical. Anything between 6 and 24 volts can be used. Stage gain remains constant, regardless of supply voltage. The supply must be well filtered to eliminate hum. With a 12 volt supply, the average current drain is only 2 mA, so the unit can easily be powered from a small 9 volt battery.

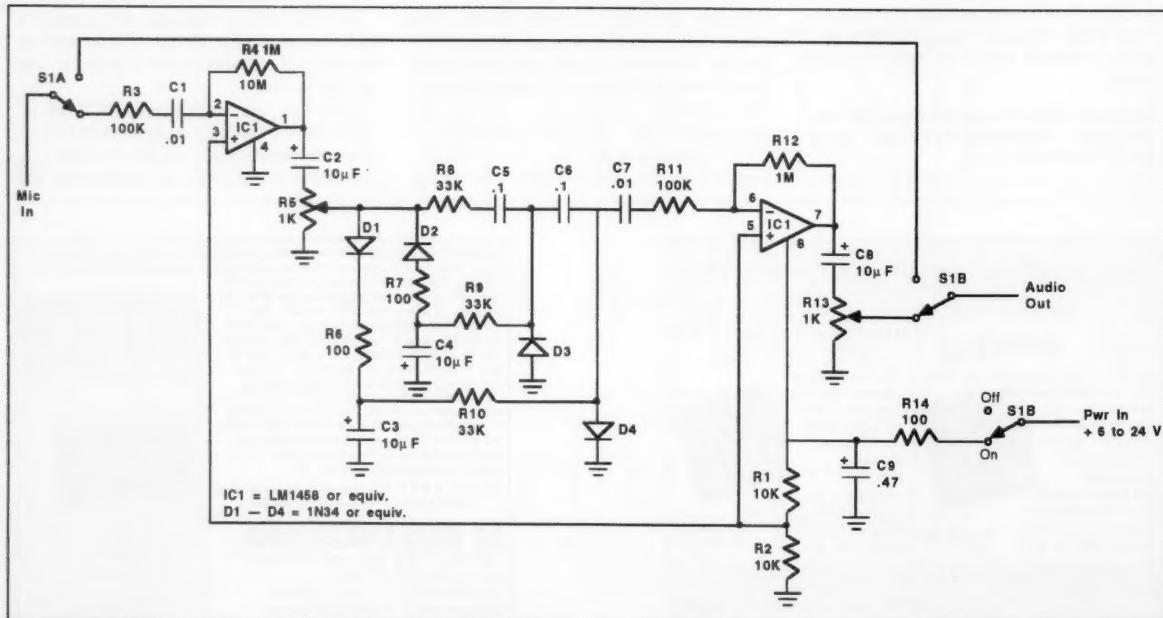


Figure 1. Schematic for the Universal Speech Processor.



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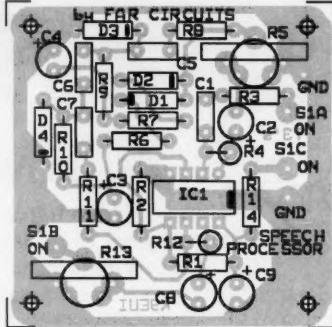
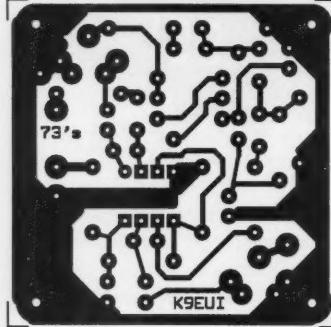


Figure 2. PC board pattern and parts placement for the Universal Speech Processor. A drilled and etched PC board for this project is available for \$4.25 plus \$1.50 S & H from FAR Circuits, 18N640 Field Ct., Dundee IL 60118.

Adjustment is best performed with the aid of a scope but can also be done with a high impedance meter (VTVM or FET input meter or DVM).

Connect the scope to the output (wiper) of R5, or connect the meter across C3. When the word "FOUR" is spoken into the mike at a slightly lower than normal level, adjust R5 so the scope indicates about 200 mV peak-to-peak, or the meter reads about 50 mV. At a normal level the scope should not peak over 2 volts peak-to-peak, or the meter should be less than 1 volt.

Compression starts at about a level where the meter reads 50 mV. At levels above 100 mV the output remains constant. With a sine wave applied to the input, the output remains sinusoidal until the voltage across C3 reaches about 3.5 volts. In other words, with a variation of from 1 to 6 volts peak-to-peak at the output of R5, the output level remains constant and does not clip.

R13, the output control, is adjusted so that with normal speech the mike gain control on the rig is at its normal position.

A word of caution here. While there is a constant output level for an input variation of 30 dB with a signal generator source, this does not mean you can operate your rig so its meter reads maximum output. A signal generator is not the same as speech! Because the attack time of the processor is not instantaneous, there is some overshoot at the beginning of

speech input. Final analysis should be done with the aid of a scope that is monitoring the RF output of the rig. Unless you can determine peak modulation levels in this manner, do not hit peaks as indicated on your rig's meter, greater than half your normal maximum available power.

In addition to increasing the average modulation percentage, this processor also helps intelligibility by tailoring the frequency response. At 300 Hz, the response is down 6 dB. Low frequencies in the voice range waste energy and should be reduced, especially if you have a bassy voice.

### Signal Quality

I have found that it is very difficult to get valuable information about the quality of my signal from anyone listening to it. If you tell someone that you are using a processor, chances are they will tell you it sounds bad no matter how well it is working.

A good way to judge the quality of your signal is to operate the rig into a dummy load and pick it up on another receiver. If necessary, attenuate the RF signal into the receiver so it stays below S-9. Record the received signal on a good quality tape recorder and listen to the results. Reduce the RF level into the receiver to S-5 or less and record the results again, with and without the processor, for comparison. If you are pleased with the results, so should everyone else who hears you.

### Parts List

Component	Description	Radio Shack #
IC socket	8-pin DIP	276-1995
IC1	1458 Dual Op Amp	276-038
D1-D4	1N34 or equiv.	276-1123
C1, C7	0.01 μF	272-1065
C5, C6	0.1 μF	272-1069
C2, C3, C4, C8	10 μF	272-1436
R1, R2	10k	271-1335
R3, R11	100k	271-1347
R4, R12	1 MEG	271-1356
R5, R13	1k pot	271-280
R6, R7, R14	100 ohms	271-1311
R8, R9, R10	33k	271-1341

# Stacking UHF Antennas

*Get gain with less pain.*

by Ronald Baker WB4HFN

Venturing into amateur television or "ATV" for the first time presented me with new and exciting challenges. Not only was I operating at unfamiliar frequencies; I also had to deal with the greater bandwidth needed for video transmission. The most important consideration for me was the antenna system.

Towers and large obtrusive antennas are not allowed in my subdivision. Next to a good antenna system, overall height is the most important factor. For my application, height was not a problem since I live on a hilltop several hundred feet above average terrain. My problem was to design a good antenna system that would be physically small and still provide adequate gain.

## Design

In talking with other hams operating ATV, the general recommendation was: "The higher the better, using the biggest antenna you can rotate." Antenna-wise, most of the operators were using antennas with gains of 13.5 dB to 18 dB. Researching various antennas, I found that for the required gain the boom length is 10 to 20 feet. That length would be too obtrusive for my neighborhood. To solve this problem, I set out to design and build an antenna system that would give me a minimum of 14 dB gain with an overall boom length of under five feet.

Not knowing a lot about VHF/UHF antenna design, I first looked at various antenna manufacturers and discovered that Cushcraft makes a beam that covers the 430 to 440 MHz band, with 11.5 dB gain, and a boom length of four feet. It seemed to fit my requirements, except for the gain.

I erected a system using this antenna and found that it performed well, but the lack of gain was very noticeable. The antenna match right out of the box was almost perfect. I measured very low standing wave or reflected power with a Bird model 43 wattmeter at 432 MHz. At this point, the on-

ly thing I needed was more gain. One way to quickly get an additional 3 dB would be to stack two antennas together. Since the antennas are vertically polarized, stacking would eliminate the need for a Fiberglas mast. Normally, a metal mast going through a vertically mounted beam tends to distort the radiation pattern and can affect the overall gain, especially at VHF/UHF frequencies.

There are many different types of UHF beams on the market today, but most are not

the 430 to 440 MHz range. This is the SSB portion of the band and is shared with the upper half of the ATV band. This segment of the band is usually where you will find ATV repeater input frequencies, which will present a good match to your ATV transmitter.

Signal loss in the 420 to 430 segment was noticeably greater. This segment is usually reserved for the ATV repeater transmitters, which have the signal advantage over an individual station. Also, receive signal loss can be further minimized by using a good RF preamp, preferably mast-mounted. Most ATV operators will tell you that using a good RF preamp is essential, no matter what type of antenna design you use.

When it came to stacking UHF antennas, I thought it a simple matter to mount two antennas, hook up a phasing harness, and attach the feedline. WELL . . . ALMOST! Mounting the antenna was a simple task. Using a "T" configuration mast I mounted the antennas on each end with 26 inches separation, as specified by the manufacturer. The actual separation between antennas varies with the type of antenna and boom length. Figure 1 shows the overall construction.

The antenna phasing harness presented an interesting challenge. I had two options for a harness: Purchase one or construct my own. Spending \$50 for a ready-made harness consisting of four coax connectors, one "T" connector, and a few feet of RG-59, was totally out of the question. Not knowing much about phase harness construction, I hit the books for information. I was surprised to find little information available, and what I did find was vague, with no clear-cut answers. I even contacted the antenna manufacturer where I received a few suggestions, but again nothing definite.

With all the discussion and reading, I was able to determine the length of the cable. The cable from the "T" connector to the an-

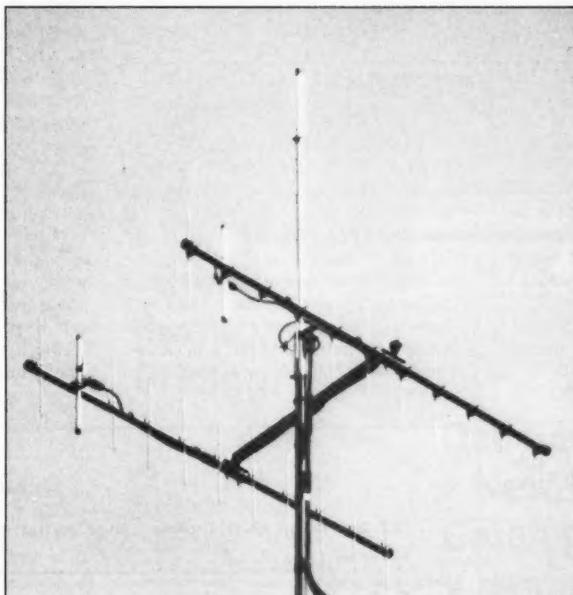


Photo A. The stacked UHF antennas.

suit for ATV operations. Most commercially available antennas are designed for the FM portion of the band between 440 and 450 MHz. This type of antenna works well at the designed frequencies, but performance in the 420 to 430 MHz region is compromised because the element length is too short for a proper match. Operating ATV, you will quickly learn that every dB of gain or loss affects picture quality. The Cushcraft model 432-11 antenna is still a slight compromise because it's designed to operate in

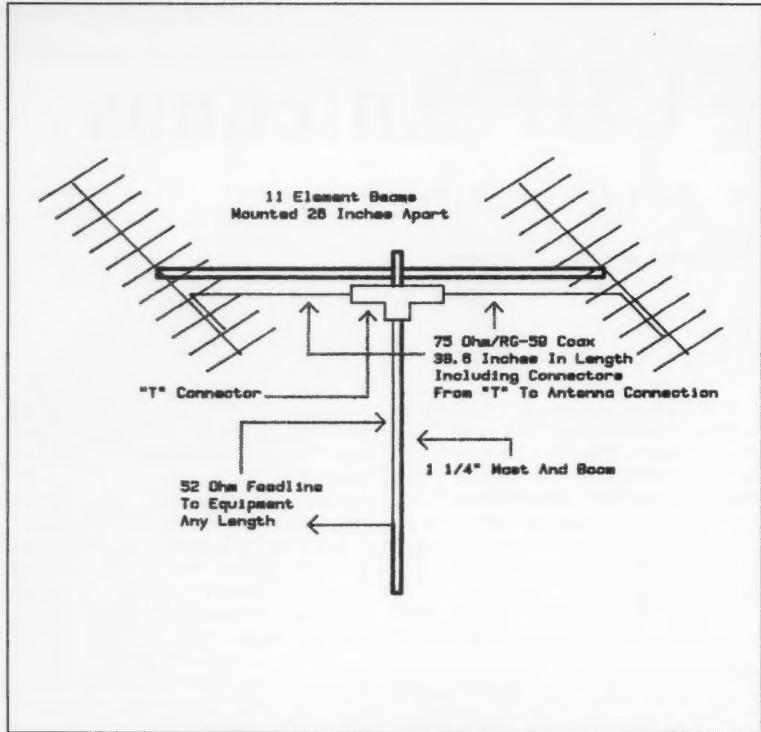


Figure 1. Final assembly detail.

tenna must be an odd multiple of a quarter wavelength, minus the length equal to the propagational delay of the cable. Propagational delay is a comparison expressed as the percentage of the time it takes for signal to travel through coax to the time it takes to travel the same distance through free space.

The cable length, including connectors, must be the same on both sides of the "T" connector. The feedline to the "T" connector from your equipment can be any length.

For example, let's use the frequency 432 MHz and RG-59 75 ohm cable.

Our formula is:  $CL = MQW \times PPD$

$CL$  = the length of the coax cable in inches, including connectors from the "T" connector to the antenna.

$MQW$  = the odd multiple of a quarter wavelength in inches, at the operating frequency.

$PPD$  = the coax propagational delay, which for RG-59 is 85%. In the formula this number is expressed as a decimal number.

First, determine the quarter wavelength of the operating frequency using the formula:

Quarter wavelength in inches =  $2808/\text{frequency in MHz}$

In our example: Quarter wavelength =  $2808/432$

Quarter wavelength = 6.50 inches

Next, determine the length of coax needed between the "T" connector and the antenna. For my project I needed a minimum of 35 inches of cable to make the connection from the "T" connector to the antenna. I chose to use the seventh multiple, which gave me an

overall length of 45.50 inches. Next, we multiply this number by the coax propagational delay of 85 percent, as shown below.

$$CL = MQW \times PPD$$

$$CL = 45.50 \text{ inches} \times 0.85$$

$$CL = 38.67 \text{ inches}$$

As shown in our formula, the proper coax length for the phasing harness is 38.67 inches from the "T" connector to the antenna. This measurement is tip-to-tip, with connectors as shown in Figure 2.

## Tuning

Tuning the antenna system is a simple task. You must use a power meter or SWR bridge designed for UHF, such as the Bird Model 43. The meters designed for HF and even 2 meters are usually not accurate at UHF frequencies.

After the antenna system has been assembled and mounted on the "T" shape boom, tune both antennas individually for minimum reflected power or SWR. In this step the coax from your equipment is connected directly to the antenna. The phasing harness is NOT connected.

After both antennas are properly tuned individually, connect the phasing harness to the antennas as shown in Figure 1. If everything is tuned properly and the harness is cut correctly, the SWR should still be good, but slightly higher than the reading you had with each antenna individually. At this point, all further adjustments to fine-tune the antenna array can be made by adjusting only one antenna. It doesn't make a difference which one you use to make the adjustments—the important thing is to adjust only one antenna. I tried various methods of adjustment and found that this method works the best.

Overall antenna performance in the upper portion of the band was very good, considering the antenna's size. The manufacturer antenna gain specification for this design was 16.8 dB. Even though I feel this may not be a realistic figure, there was a definite improvement over a single antenna of the same type. In comparing this design with the larger ATV antennas, it performed very close to the antennas in the 10 to 14-foot range that give between 14.2 to 14.8 dB gain.

If you need a good antenna system on ATV and have space limitations, this design works well. At UHF frequencies, height above average terrain is extremely important. Even the best antenna system performs poorly if you're looking into trees, hills or nearby structures.

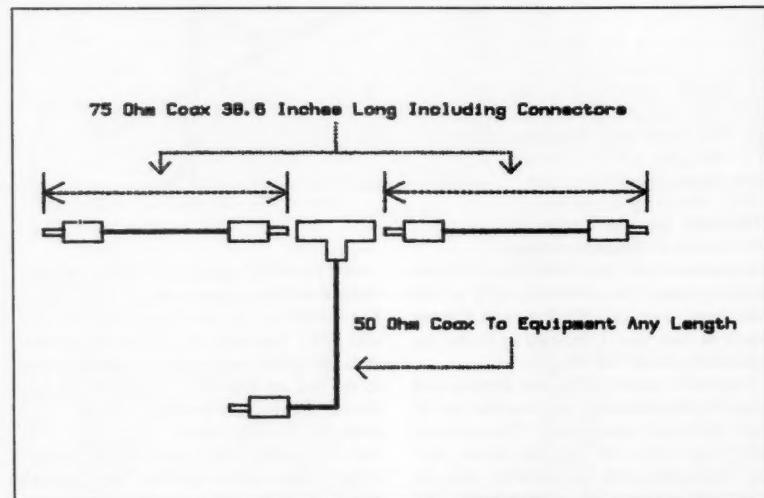


Figure 2. Phasing harness detail.

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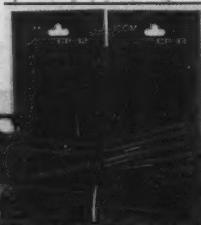
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### KENWOOD

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CIRCLE 153 ON READER SERVICE CARD

# Nine to 10

*What to do when 10 meters is closed.*

by Paul M. Danzer N1II

Just a few short months ago many of us were routinely talking to Europe or Asia with our low power 10 meter mobile rigs as we commuted back and forth to work. Then there were more and more days where our favorite DX friends were too weak to copy, and then more and more days when they could not be heard at all.

The culprit, of course, is the 11-year sun-spot cycle. At the peak of the cycle, which occurred a few years ago, 5 to 25 watts on 10 meters was enough to cover much of the world. Now that we are going down towards the low part of the cycle, more and more often nothing can be heard: "The band is dead."

## **Leave Your Rig in the Car**

The temptation is to say OK—if 10 is dead I might as well take the rig out of the car. But 10 is a funny band; closed one day and suddenly open the next. Quiet one minute and full of DX the next, as the sun erupts and quiets down.

Instead of taking the rig out of the car, you could try to find a use for it when 10 is closed. The converter shown in block form in Figure 1 does just that.

**10 May Be Closed but Other Bands Are Open**

The 10 meter band extends from approximately 28 to 30 MHz. Your 10 meter rig has a very sensitive and selective receiver. Figure 1 shows a converter which can be built in just one evening. It allows the receiver to cover a shortwave band. This way, when 10 is closed you can monitor a shortwave band instead of the "golden oldies" played on your local broadcast station.

The 9 MHz shortwave band is a good choice. Open at all hours in most places to some part of the world, it is a compromise between the higher shortwave bands (13, 15, 17, and 19 MHz), which tend to be closed at night during this part of the sun spot cycle, and the lower shortwave bands (7 and 6 MHz), which are usually closed during the day.

Picking the 9 MHz band has another advantage—you get the 8 MHz ship band (including weather, telephone calls, and

inter-ship messages) which can also make for very interesting listening.

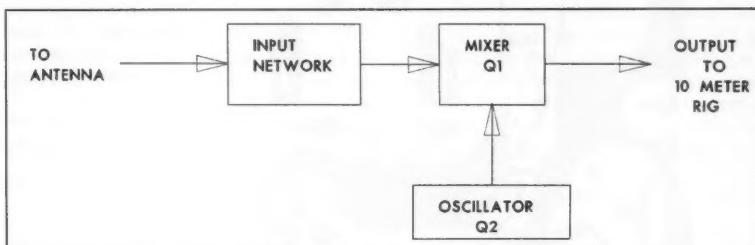
## How Does It Work?

Figure 1 shows the flow of signals in the converter. Your 10 meter antenna is connected to an input network (to be discussed later). A single field-effect (FET) transistor, Q2, acts as an oscillator at 20 MHz. A second FET is used as the mixer. Stations in the frequency range of 8 to 10 MHz go through the input network into the mixer, which adds 20 MHz to their frequency. Thus, a station on 9.1 MHz comes out of the mixer at 29.1 MHz ( $9.1 + 20 = 29.1$ ).

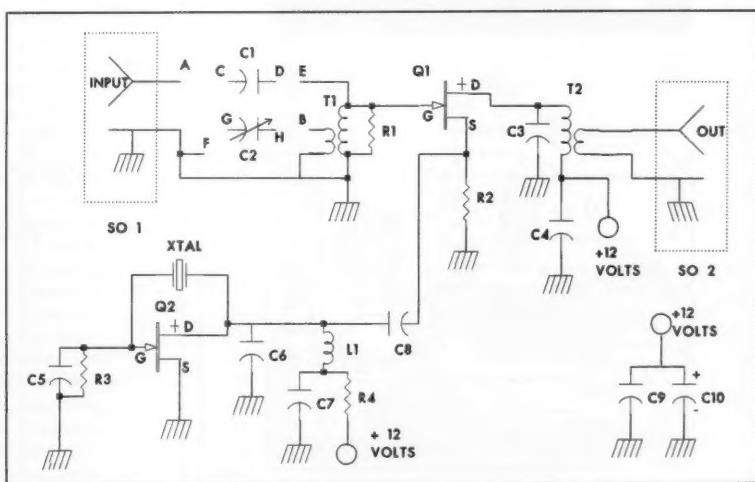
The result is that the marine (ship) frequency band in the range of 8.2 to 8.8 MHz is converted to 28.2 to 28.8 MHz, and the shortwave broadcast band of 9.5 to 9.9 MHz is converted to 29.5 to 29.9 MHz. Don't be surprised to hear shortwave broadcasts outside of these limits since not all countries play by the rules!

### **Two FETs and One Crystal Do It All**

Figure 2 shows the schematic for the converter. The oscillator consists of FET Q2 and a 20 MHz crystal (marked XTAL) in a Pierce oscillator. The circuit is simple, uses a minimum number of parts, and works well with very inexpensive crystals.



*Figure 1. Signal flow*



*Figure 2. Schematic for the converter.*

Q1, also an FET, is a source injection mixer. It produces both the sum and difference of the input signal and the 20 MHz local oscillator. The output circuit, consisting of the larger winding of T2 and capacitor C3, is broadly tuned to the sum frequency range.

We don't really want any selectivity from this circuit since we have plenty of selectivity in the 10 meter receiver connected to it.

The circuit operates from 12 volts. It would probably operate just as well from 9 volts, but since your car supplies 12 volts, that voltage is used. C9 and C10 are bypass capacitors to clean up the 12 volt line a little bit on the converter board.

#### The Input Network

When your 10 meter rig is connected to your 10 meter antenna and the standing wave ratio (SWR) is low, the antenna looks like a 50 ohm source plugged into a 50 ohm receiver input. However, your 10 meter antenna, when measured at the end of a transmission line, can look like just about anything you can imagine when it is measured at 9 MHz.

That's exactly what we are doing with

this converter—trying to use a 10 meter antenna at 9 MHz. Therefore, as the schematic (Figure 2) shows, the input connector (SO1), two capacitors (C1 and C2), and the input transformer (T1) are important.

These components can be connected in several ways (see Figure 6) to get the maximum signal from the antenna to the converter, and the connection of these parts is part of the simple tune-up process.

#### Build It in One Evening

The original model of this converter was built on a breadboard unit available from Radio Shack (part #276-174, the Experimenter's Socket). The layout is not critical. The oscillator is built on one end of the breadboard unit, with the converter on the other end. It can also be built on perf board fit with standard "flea" clips if they are available.

But, the best way to construct the unit is with a printed circuit board. Figure 3 shows the layout of the board and the parts placement diagram. The board is available from FAR Circuits, 18N640 Field Court, Dundee IL 60118, for \$3.50 per board plus \$1.50 shipping and handling per order.

T1 and T2 are made from 100  $\mu$ H chokes (Radio Shack #273-102). Each choke comes wound with two layers of wire. Only 20 turns of wire are needed for the large winding

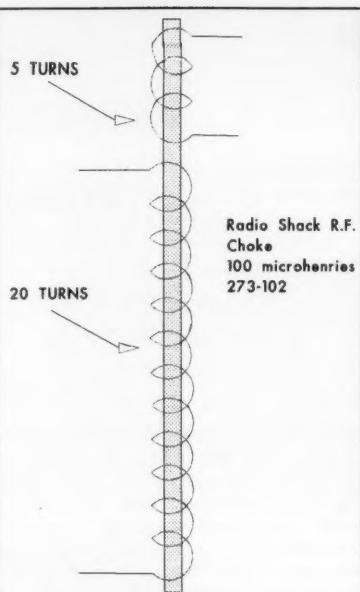


Figure 4. Choke winding diagram.

in T1 and T2, so strip off the excess wire until only 20 turns are left, and then reconnect the free end of the wire.

Take the surplus wire you have cut off and wind five turns for the second winding. Twist the leads to the five turns together to keep them from unraveling. Don't be overly concerned about how neat these transformers look—they do not have to be very precise.

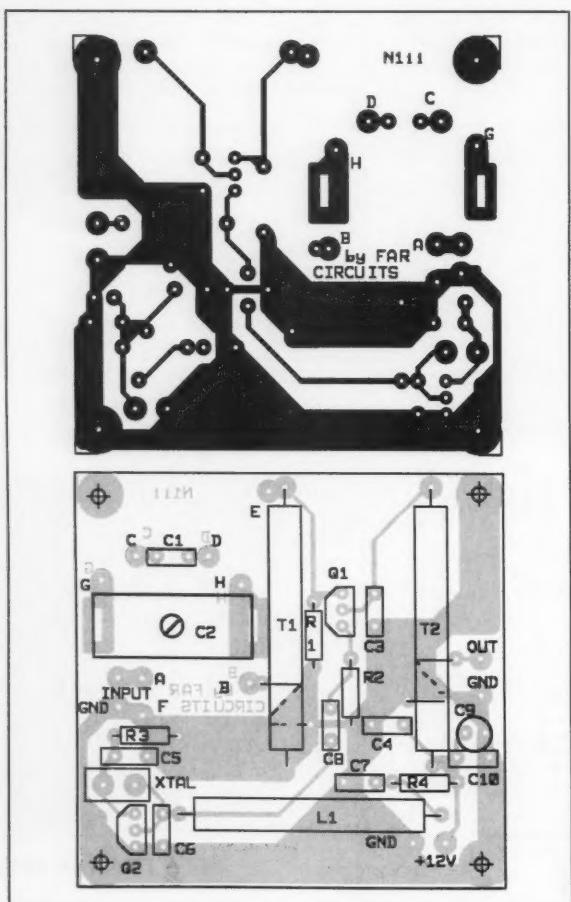


Figure 3. PC board and parts placement diagram.

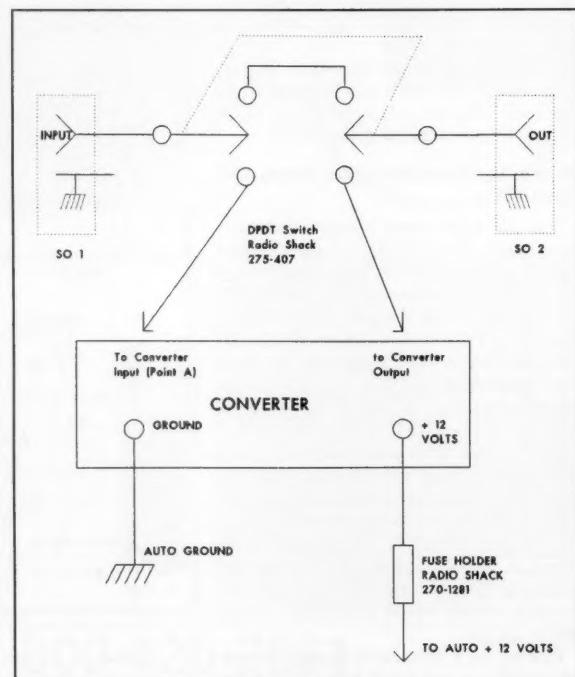


Figure 5. Set up the converter in your car.

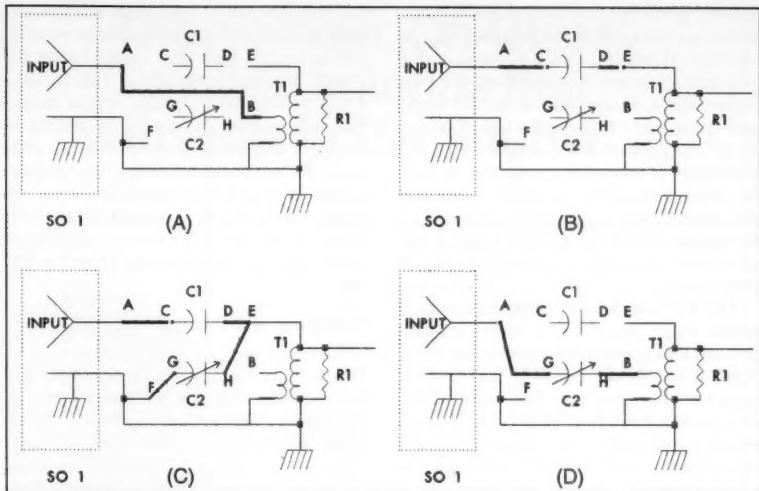


Figure 6. Tune the converter by configuring these jumper wires as shown for best results.

According to the Parts List, C5 is a 4.7 pF. Occasionally you might run into a crystal which does not want to oscillate with this value. In that case wire two identical 4.7 pF capacitors in parallel in place of the single unit.

#### Plug It In

The converter is connected by removing the antenna lead from your 10 meter rig and connecting the lead to SO1. A new piece of coax with connectors is used to connect the output of the converter at SO2 back to the input connector on the rig. Fi-

nally, the 12 volt input of the converter is connected to a 12 volt source in the car.

It is best to connect the 12 volts through a fuse. The converter draws only a few milliamperes so the fuse will only serve to protect you from a major short circuit. An in-line fuse holder, such as Radio Shack #270-1281 with a 1/4 ampere fuse, will do the job nicely.

If you wish, you can wire the converter with a double-pole double-throw switch, such as that shown in Figure 5. This would allow switching the converter in and out of the antenna line without the bother of removing the antenna line and reconnecting it.

When the converter is connected,

make sure that you do not key your microphone! Transmitting with the converter in the line will probably result in blowing transistor Q1.

#### Tuning it Up

There is no real tune-up process except for the initial connection of the jumpers in the input network. As I mentioned before, your 10 meter antenna, depending on its size and type, can look like almost any impedance to the converter at 9 MHz. The input network was designed to allow you to try to get maximum signal from the antenna to the converter.

Each of the suggested connections shown in Figure 6 can be tried to achieve best results. The heavy line represents a jumper. Start with jumping A to B as in Figure 6A. Then try some of the other variations to see which provides best results.

Both 6C and 6D include the use of variable capacitor C2. Adjusting C2 can make a major difference or no difference at all, depending on your antenna.

If you mount the converter in a plastic box, don't be surprised if several shortwave broadcast stations come in loud and clear with no antenna at all. In many areas they are so strong that they tend to ride through no matter what you do.

#### What You Can Hear

The 9 MHz shortwave band is listed as between 9.5 and 9.9 MHz, meaning that you will hear these stations on 29.5 to 29.9 MHz on your 10 meter rig. But don't be surprised to hear them at frequencies as low as 9.1 MHz. The band is pretty crowded and often stations will migrate just to find a clear spot—just as hams do!

When east-west propagation is down on the 9 MHz band, north-south propagation

Table 1. Marine Band Frequencies

(If only one frequency is listed both the ship and shore station or other ship use that same frequency.)

Ship	Shore	Use
8291		Emergency and Distress
8255	8779	Ship/Shore Calling/Reply
8201		Inland (River) Simplex
8213		Inland (River) Simplex
8725		Inland (River) Simplex
8737		Inland (River) Simplex
8294		Private company use
8297		Private company use
8113	8713	Ship-to-Shore Telephone
8128	8716	Ship-to-Shore Telephone
8198	8722	Ship-to-Shore Telephone
8204	8728	Ship-to-Shore Telephone
8207	8731	Ship-to-Shore Telephone
8216	8740	Ship-to-Shore Telephone
8219	8743	Ship-to-Shore Telephone
8222	8746	Ship-to-Shore Telephone
8225	8749	Ship-to-Shore Telephone
8234	8758	Ship-to-Shore Telephone
8237	8761	Ship-to-Shore Telephone
8264	8788	Ship-to-Shore Telephone
8267	8791	Ship-to-Shore Telephone
8270	8794	Ship-to-Shore Telephone
8279	8803	Ship-to-Shore Telephone
8282	8806	Ship-to-Shore Telephone
8285	8809	Ship-to-Shore Telephone

Table 2. Aircraft Band Frequencies

Frequency	Use or Area
8015	Alaska
8364	Search and Rescue
8822	Flight Test
8825	North Atlantic
8831	North Atlantic
8843	Central East Pacific
8846	Caribbean
8855	Alaska, South America
8861	South Atlantic
8864	North Atlantic
8867	South Pacific
8876	Alaska
8879	North Atlantic, Indian Ocean
8891	North Atlantic
8894	Africa
8897	East Asia
8903	Central West Pacific, Africa
8906	North Atlantic
8918	Middle East, Caribbean
8933	Long-Distance Control
8942	Southeast Asia
8951	Middle East

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HFA20	14.0-14.35
HFA30	10.1-10.15
HFA40	7.0-7.3
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usually picks up, so South American stations can predominate at certain times of the day. However, don't be surprised if you hear European stations when you least expect them. Many of them do not transmit from their home countries but use multi-megawatt relay stations in the Caribbean to carry their programs. In fact, the same transmitter, on slightly different frequencies, can be rented to one country's broadcast service for several hours a day and then to another country for a few more hours.

The 8.2 to 8.8 MHz range is a marine traffic band. Several U.S. shore stations provide weather broadcasts on voice at the hour or half hour; the only way to find them for your area is to tune around. Marine stations have two modes of operation: simplex and duplex. On simplex, both the shore station and the ship station use the same frequency. Duplex provides both a ship transmit frequency and a different shore station frequency.

Inter-ship communication (ship to ship) is usually carried on simplex, and telephone calls are carried on duplex. Table 1 provides a number of suggested frequencies to monitor.

The converter also covers the aircraft band of 8.8 to 9.1 MHz. Within this band

you may be able to hear trans-oceanic aircraft providing position reports to air control centers on both U.S. coasts. Listen for a burst of a few audio tones. This is SELCAL, or Selective Calling, which means that someone on the ground is dialing or calling a particular aircraft. Table 2 contains the international frequency assignments in this band. There is almost no QRM; you might be surprised at how well some of the aircraft stations propagate when they are transmitting from 35,000 feet.

#### Variations and Changes

Don't be hesitant to experiment. The converter is not sensitive to changes and has no critical elements. For example, if you use a 13 MHz crystal instead of the 20 MHz unit shown, and take a few turns off the large winding of T1, you can cover the 15 MHz shortwave broadcast band. Changing the crystal to 13 MHz means that your converter output is  $13 + 15 = 28$  MHz, so the new crystal provides a different shortwave band.

Try the converter! With just one evening's work you can enjoy your 10-meter rig in the car when the band is closed and you would like to hear something other than a 30-year-old pop tune.

#### Parts List

(All parts numbers given are Radio Shack, unless otherwise noted.)

R1	30k	1/4 watt	271-040
R2	3.3k	1/4 watt	271-028
R3	47k	1/4 watt	271-042
R4	100 ohms	1/4 watt	271-012
C1	4.7 pF	Disk—50W VDC or more	272-120
C2	95-420 pF	Trimmer cap	272-1336
C3	4.7 pF	Disk—50W VDC or more	272-120
C4	001 MFD	Disk—50W VDC or more	272-131
C5	4.7 pF	Disk—50W VDC or more	272-120 (see text)
C6	47 pF	Disk—50W VDC or more	272-121
C7	0.01 MFD	Disk—50W VDC or more	272-131
C8	100 pF	Disk—50W VDC or more	272-123
C9	0.01 MFD	Disk—50W VDC or more	272-131
Q1	10 MFD	Electrolytic—35W VDC	272-1013
Q2	MPF102	Field effect transistor	276-2062
T1	100 μH	RF choke 273-102 (modified—see text)	
T2	100 μH	RF choke 273-102 (modified—see text)	
L1	100 μH	RF choke 273-102	
SO 1	239 type	UHF socket	278-201
SO 2	239 type	UHF socket	278-201

\*XTAL 20 MHz Microprocessor crystal in HU 18/U case (wire leads)

\*These crystals are available by mail order from several sources at less than \$3 each. One source is All Electronics Corporation in Van Nuys, California. Their catalog is available by calling (800) 826-5432. The crystal is listed in their catalog as CRY-2018, for \$1.25. Their minimum order is \$10, and you should be able to get many of the parts above for this minimum.

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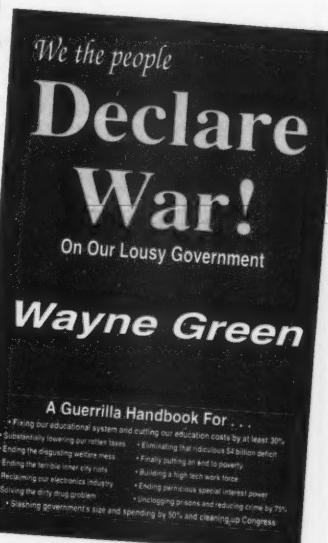
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Jeffrey Sloman N1EWO  
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Franklin IN 46131

## Hierarchical Addressing

This month we'll take a look at a part of packet operation that is both very simple and (apparently, based on mail received here at N1EWO) confusing. It takes just a little understanding of this scheme to make it crystal-clear.

### What Is Hierarchical Addressing?

Hierarchical addressing is a scheme which allows packet traffic to be routed easily by the stations that comprise the amateur packet network. It eliminates the need for each station in the chain to know exactly where to send a particular message or bulletin. To understand how it works, let's take a look at the term itself.

Working backwards, we have "addressing." The idea of addressing is easy for all of us to understand. Addressing a packet message is just like addressing a letter. It tells the delivery system—packet network or post office—where to route the addressed item. Then there's "hierarchical," a

word that many people have a tough time pronouncing. Say "hi-ur-ark-ik-ul." What is meant by this word is that the addressing scheme has a hierarchy from very specific—a particular ham—

N1EWO@N0ARY.#NOCAL.CA.US  
A.NA

There are clear parallels between the two schemes. Ignoring for the moment the ZIP code, which actually uses its own hierarchical scheme, let's compare elements directly. The most specific information in each case is the recipient—me, Jeffrey Sloman or N1EWO. This says exactly who should receive the message. It is, therefore, at the very top of the hierar-

formation to the delivery system. However, in order for the system to work, it must already know *something* about what the address means. If it did not, you would have to provide detailed instructions (e.g.: "go three blocks on Main Street and turn left—it's the green house on the right," or a list of every PBBSS between you and your recipient) that would be impossible to handle. So the point of the address is to let the delivery system know, in

**"Let me point out something interesting here:  
When you address a message you are providing certain  
information to the delivery system. However, in order for  
the system to work, it must already know something  
about what the address means."**

to very general—a continent. These elements are arranged in a "hierarchy," hence the name.

This is really no different from our previous example of an ordinary letter. Let's compare the two:

To send me mail, you address your envelope:

Jeffrey Sloman  
P.O. Box 636  
Franklin IN 46131

To send me a packet message, you address it:

chy. If this were the only information the address provided, a huge file listing the addresses of every possible recipient would have to be kept by the post office—an impractical situation, since names are not unique)—and by the PBBSS (Packet Bulletin Board Systems) that make up the forwarding network—not as difficult, but still hard to maintain).

Let me point out something interesting here: When you address a message you are providing certain in-

shorthand, some generic and specific information about the desired destination that it can use to get your message there.

The next, less specific, element is P.O. Box 636 or N0ARY. This is the place that the mail will be delivered for me to retrieve (note that a street address serves the same purpose). This is followed by a Franklin and #NO-CAL. Notice that there is a "#" in front of "NOCAL." This is because it is an optional, regional destination. The "#"

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lets the PBBS know how to interpret this element. Many states have regional addresses which help speed forwarding. Your area probably has at least a couple of divisions that you can use to direct traffic. You can ask a local user, write a message to the PBBS sysop (SYStem OPerator), or just watch traffic go by to find out how your area works.

The next element is IN or CA. These are exactly alike—they name the state to which the traffic will be sent. The packet address has additional information: USA—for United States of America, of course—and NA for North America. This information is assumed by the post office, so it is left off.

Now, while a packet address is written from top to bottom, it is used exactly the other way. By sending a message to the station responsible for the next element, (starting from the least specific), any particular station needs only to know about its own area in detail, (and only generally about other areas). In the example of my packet address, let's pretend we are sending me a message from France. We log on to a local PBBS and compose a message. We address it using the full hierarchical address. The local PBBS sees the very bottom of the address—NA. We are in Europe, so the PBBS knows that this message isn't even on the right continent yet!

The French PBBS need not be concerned with any other address information—it will just squirt the message across the HF link to the North American PBBS which it knows is responsible for handling message bound for North America. Now the North American PBBS, located in Canada, receives the message. It looks at the next element in the address and sees that it is USA. No problem—it sends the message to a PBBS in Boston which it uses to forward US messages. This PBBS—you guessed it—

a message makes is completely dependent upon the network resources available at the time. I just wanted you to get a feel for the utility of hierarchical addresses.

#### Practical Addressing

So now that you have a feel for what hierarchical addressing is, how do you use it? The fact of the matter is, you are probably better off just using an abbreviated address. That is, you should use just the recipient and PBBS:

**"Now you can venture out into  
the world of packet radio, armed with  
your new knowledge and ready to  
send messages to anyone,  
properly addressed."**

looks at the next element, CA. The message gets forwarded to the next PBBS in the chain because it is on the path to California. This process continues until the message arrives at its destination.

Please note that the example above may not reflect reality. Depending upon the availability of links, the French PBBS might have forwarded directly to California. How many hops

N1EWO@N0ARY

This is because the rest of the address is most likely already stored in the PBBSs database, and if you make a mistake, even a small one, in writing out the whole address, your mail will sit until the sysop can straighten it out. If you are confident of your ability to not screw up, you can include the whole address. If you have regular correspondence with a user of a re-

mote PBBS, you need only use the whole address once and the PBBS will remember. If you use a truncated address, and the PBBS cannot fill in the rest, you will probably get mail from the sysop asking for the information.

So, while I can't say you now know everything about hierarchical addressing, you should know enough to feel comfortable with it. Now you can venture out into the world of packet radio, armed with your new knowledge and ready to send messages to anyone, properly addressed.

#### Survey News

By now, I had hoped to have the survey results compiled for publication. Unfortunately, the whirlwind of activity here at N1EWO has prevented me from doing it. I will, however, have the data available for the next issue. Thanks to all who responded. 73 de N1EWO.

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Paper Mail:

N1EWO  
P.O. Box 636  
Franklin IN 46131

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## Selecting Variable Capacitors, Part I

Variable capacitors are a regular part of amateur radio circuits. While the new generation of hams might see fewer variable capacitors in their modern equipment (phase-locked-loop synthesizers and solid-state RF power amplifiers don't use them like the "old stuff" did), they are still found extensively in antenna tuners, preselectors, and in many—perhaps most—home-brew rigs. Selecting the right variable capacitor requires a little insight into the different types of variable capacitors available. Also, you might be interested in where these "antiquities" can be purchased.

### What Are Variable Capacitors?

Capacitors are formed by placing two conductors opposite each other, separated by an insulating dielectric. Different types of dielectrics are used in variable capacitors: vacuum, air,

mica, and poly film are the most common. The capacitance is inversely proportional to the spacing between the metal plates of the capacitor (moving them closer together raises capacitance). In transmitters and antenna tuning units, there must be a trade-off between the wide spacing necessary to increase the working voltage and the narrow spacing required to increase capacitance. The capacitance is directly proportional to the area of the metal plates facing each other (whether by size of the plates or by the number of plates) and the dielectric constant of the insulator between the plates.

Making a capacitor "variable" can be accomplished in several ways: changing the spacing between plates (in compression capacitors), or changing the proportion of total plate area "shading" each other (in most rotary variable and piston capacitors). Compression capacitors are typically used for "trimmer" or "padder" applications. A trimmer capacitor is placed in parallel with the main tuning capac-

itor in an LC resonant tank circuit, while a padder is placed in series with the main tuning capacitor.

Another way to classify capacitors is according to the manner of the capacitance change when the tuning shaft changes. Photo A shows the two different forms: a straight line frequency capacitor on the left; a straight line capacitance form on the right. A straight line capacitance capacitor has a constant capacitance change per degree of shaft rotation

( $\Delta C/\text{degree}$ ). For example, suppose a capacitor is designed to provide a capacitance range of 7.7 to 100 pF, or a range of 92.3 pF over 180 degrees of shaft rotation. That capacitor will show 0.513 pF/deg all across the range. A straight line frequency capacitor uses shaped plates to account for the fact that the resonant frequency of an LC tank circuit changes as the square root of the capacitance changes. These capacitors have a constant frequency change per degree of shaft rotation.

The type of capacitor selected can have a profound effect on the look of a calibrated dial. A straight line capacitance device will cause the frequency units to scrunch up on one end of the dial (you've seen that effect on some AM band radios), while a straight line frequency device will show equal frequency change for every linear dial division. Radio receiver LOs and transmitter VFOs will usually want a straight line frequency type, while certain instruments (such as an impedance bridge) might require a straight line capacitance type.

Two different types of air variable capacitor construction are shown in Photo B. The capacitor in Photo B-1 uses two end plates (one front and one rear), while the capacitor in Photo B-2 uses a single end plate. "Conventional wisdom" suggests that the dual end-plate units offer better mechanical stability so they are better for VFO/LO applications. But in reality, there seems to be a trade-off. After building a lot of VFOs and LOs during the past 30+ years, I can't see the advantage, especially when you consider other sources of drift and shift appear far more severe in those circuits.

Note that the capacitor shown in Photo B-2 uses a ceramic end plate. Others will use a metal end plate, which also serves to ground the capacitor when it is directly mounted to a chassis. The ceramic type end plate makes it easier to "float" the capacitor. There are two ways to do this trick. First, cut a hole in the metal panel wider than the 3/8" threaded

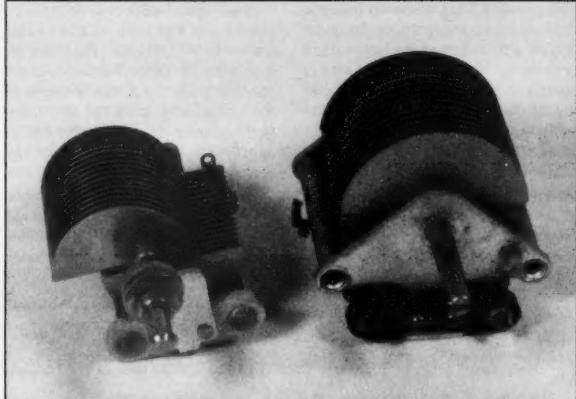


Photo A. Two forms of variable capacitor: straight line frequency (left), and straight line capacitance (right).

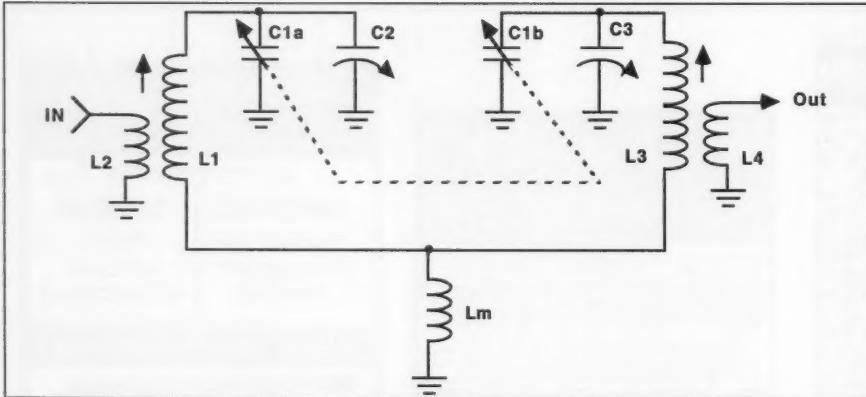


Figure 1. Doubly tuned RF "front-end" selector.

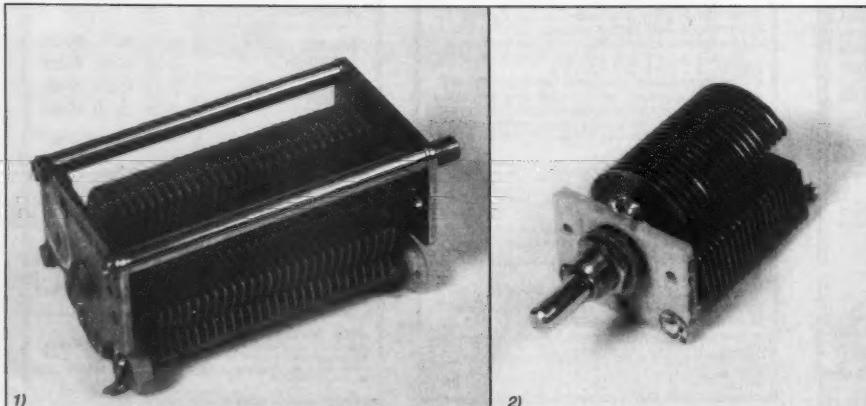
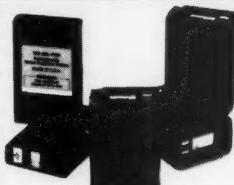


Photo B. 1) Two-end plate variable; 2) single-end plate variable.

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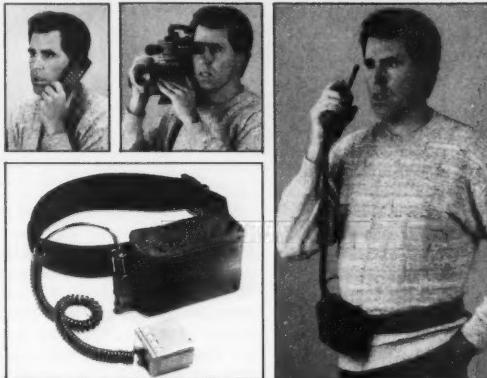
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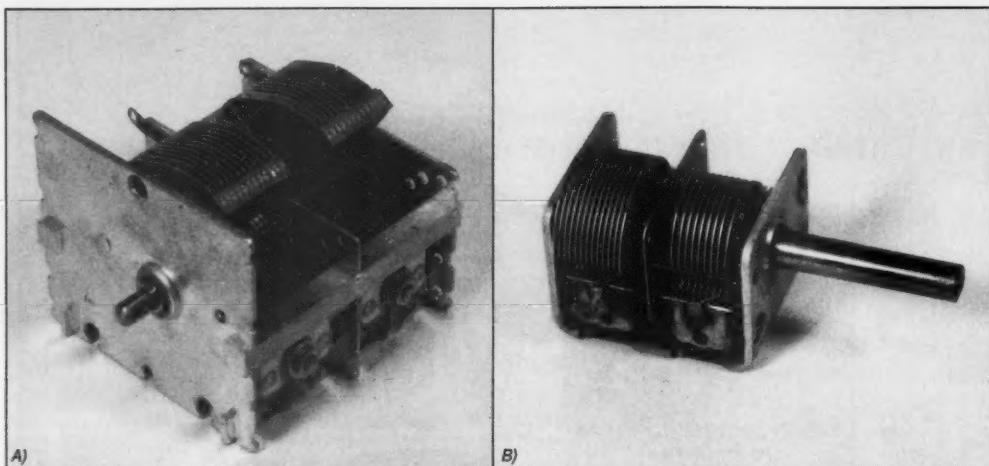
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A)

B)

Photo C. Two-section variable capacitors: A) both sections the same; B) front section smaller to tune LO (used in superhet radio receivers).

bushing, and a 3/8" hole in an insulated piece of material. The capacitor is mounted to the insulator, and the insulator is mounted to the panel. The second way is to cut the hole larger than 3/8", but also drill two mounting holes on either side of the shaft hole and use the holes in the ceramic end plate to hold small screws.

Photo C shows a pair of dual variable capacitors. The capacitor in

Photo C-1 has two sections that each have the same capacitance range. For "broadcast variables," the normal capacitance range is 10 to 365 pF, although 10-380 pF, 10-300 pF, 9-140 pF, 10-440 pF and 12-500 pF capacitors are available. The 140 pF are typically used in transistor portable radios, and the other values are found in radios from other countries. For most broadcast receiver variables

used in this country, if the two sections are identical, the range is 10-365 pF.

One application of dual capacitors is to tune two ends of a double-tuned RF input LC tank circuit (Figure 1). This circuit consists of two LC resonant tank circuits (L1/C1A/C2 and L3/C1B/C3) that are coupled together through a small mutual inductance Lm. Information on selecting the val-

ue of the mutual inductance can be found in nearly any edition of the ARRL Radio Amateur's Handbook (or Handbook for Radio Amateurs in later editions). The RF signal is coupled into the circuit through a low impedance link (L2), and out of the tank circuit by another low-Z link (L4).

Getting the two halves of the double-tuned tank circuit to "track" to the same frequency is done by making use of the variable tuning feature of inductors L1 and L3, and the trimmer capacitors (C2 and C3). In most cases, the inductors are adjusted for peak signal output at the low-end of the band, and the trimmers are adjusted at the high end of the band.

Another application of the dual variable is to simultaneously tune both the RF amplifier input and the local oscillator in a superheterodyne radio receiver. The frequencies of these circuits differ by the amount

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## RANDOM OUTPUT

Continued from page 96

of being a first QSO, this one on the 10 meter Novice phone portion. It was surprisingly similar to my own first QSO. The young newcomer was at a friend's house, "borrowing" the station for his first QSO. He was quite nervous, and admitted to being so. I told him about my first QSO, which helped to break the ice. Boy, first QSOs are sure easier on SSB! I explained to him that he didn't have to give our callsigns before and after every transmission, that the goal was to be as conversational as simplex communication will allow (advice I give to every new ham I find myself in contact with). We ended up having a nice little QSO, with his friend interjecting comments now and then. I felt I was sort of "paying back" that ham in Dallas, and my high school radio club buddies.

A few days later, I received a QSL card in the mail, thanking me for being a first QSO. I've been a ham for almost 20 years, and I've got a box full of QSL cards. I keep a half dozen or so at my operating position, to remind me of particularly pleasant contacts. I keep the "first QSO" card at the top of the pile. It reminds me of some things it would do us all well to remember now and then.

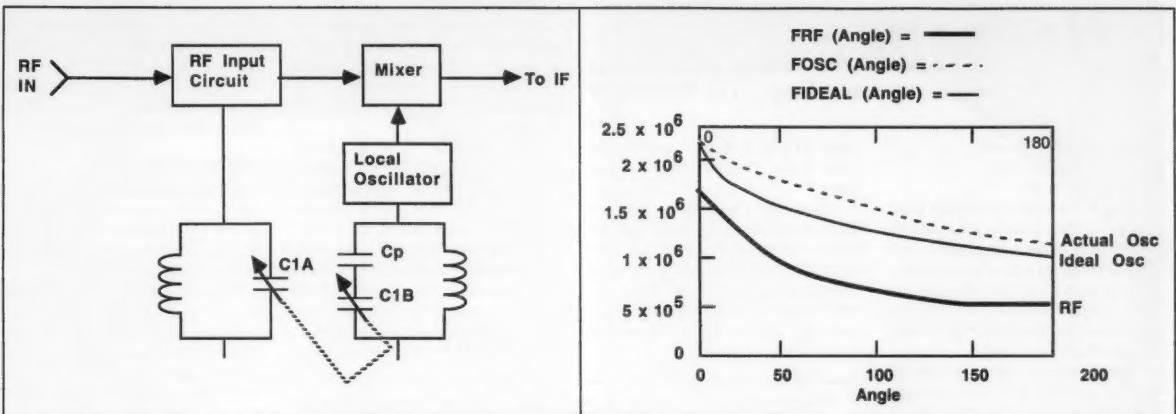


Figure 2. A) Block diagram of superheterodyne front-end showing use of the padder capacitor; B) MathCAD tuning curve for an AM BCB case using a padder capacitor.

of the IF frequency. For example, in a 75/80 meter receiver that uses a 455 kHz IF amplifier, the RF circuit will tune 3,500 to 4,000 kHz, while the local oscillator tunes from 3,955 to 4,455 kHz. The frequency ratio of the RF is 1.143:1, suggesting a required capacitance ratio of 1.143<sup>2</sup>, or 1.306. The LO, on the other hand, has a frequency ratio of 1.126:1, requiring a capacitance ratio of 1.126<sup>2</sup>, or 1.268:1. One method for achieving improved tracking between the RF

and LO is to use a padder capacitor (Cp) in series with the section of the main tuning variable that tunes the LO (C1B in Figure 2A).

There is a little bitty problem with using a padder capacitor to achieve tracking, even though it was once very popular. Figure 2B shows a MathCAD plot of the RF frequency, ideal oscillator frequency, and actual oscillator frequency for an AM BCB case (225  $\mu$ H inductor, and 2X 365 pF capacitor). Note the large depar-

ture between the ideal and actual local oscillator frequency curve. This problem is fixed by using a specially designed variable capacitor, like Photo to C-2, in which the front section is smaller (and has slightly differently shaped plates in some models). The front section is designed to tune the LO frequency range, while the rear section tunes the RF frequency range. Popular combinations include 8.5-105 pF/15-480 pF and 10-140 pF/12-420 pF.

#### Next Month . . .

In the final installment of this two-part series we will take a look at transmitting variable capacitors, the differential variable, the split-stator variable and some of the circuits in which these are used. Another topic in Part II will be calculating the trimmer values and inductance values needed for tuning a specified frequency range (like a ham band). We will also look at some sources of supply for variables.

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# HAMSATS

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## Amateur Radio Via Satellites

Andy MacAllister WA5ZIB  
14714 Knightsway Drive  
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One of the most formidable challenges for the amateur radio satellite chaser is to make a successful voice or packet contact with a space shuttle. Making such a contact will require a level of operating skill, patience and equipment performance not needed for regular hamsat activity.

The amateur radio equipment carried on the shuttle is part of SAREX, the Shuttle Amateur Radio Experiment. Various equipment configurations have been in use since 1983 when Owen Garriott went to space in the *Columbia* on mission STS-9. He operated voice on 2 meters. Many SAREX missions have followed.

STS-56 flew in April 1993, carrying equipment for packet, voice, SSTV and FSTV reception. The mission was a success, with a full schedule of school contacts, FSTV tests, some SSTV activity and general QSOs.

In May, STS-55 carried packet and voice gear, known as configuration "C," in conjunction with the German SAFEX (Shuttle AmateurFunk EXperiment) equipment for 70cm FM operation. Comparisons were made between the window-mounted SAREX antenna and the quarter-wave whip attached to the outside of the German spacelab. The whip performed 12 dB better than the window antenna.

Three more SAREX flights are planned this year, including STS-57 in

June, STS-58 in August and STS-60 in November. They will use packet and voice.

The shuttle is typically in a low orbit between 120 and 310 miles, with an inclination between 28 and 57 degrees. This means short passes, a variable orbital decay rate and low elevation angles for antennas. There are also large Doppler shifts of the signal frequencies.

**"Such obstacles cause some amateurs to give up while inspiring others to try every means available to make a contact. Before attempting a shuttle contact be sure to observe the rules of the game."**

The ham-astronauts cannot operate on every pass for general contacts. The work timeline and scheduled contacts with schools and families take precedence. The packet equipment, if on board, is usually active for those passes when the astronauts plan no other ham activity. But even the packet has been shut down when the antenna window is required for photography and other experiments.

The SAREX antenna is mounted in one of the cabin windows and can be shadowed by the spacecraft. Signals can be difficult to copy for as much as half the pass. This affects uplink signals as well.

### SAREX Procedures

Such obstacles cause some amateurs to give up while inspiring others to try every means available to make a contact. Before attempting a shuttle contact be sure to observe the rules of the game.

First, never transmit on 145.55 MHz; second, never call the shuttle if transmissions from the spacecraft are not on 145.55 MHz. Many stations have been heard calling on 145.55 MHz. Although the SAREX Motorola HT is capable of reception on 145.55 MHz, experience has shown that split-frequency operation is necessary. Voice uplinks for all stations except Europe start at 144.91 MHz and go to

144.99 MHz in 20 kHz increments. Except in emergencies, the SAREX HT will never be set to receive on 145.55 MHz.

For packet activity, the uplink is 144.49 MHz and the downlink is 145.55 MHz. When sending connect requests, call W5RRR-1. The specially modified Heathkit TNC uses the call-sign of the Johnson Space Center Amateur Radio Club with a "-1" SSID (sub-station identifier) at the end. The packet operation does not currently use a standard 600 kHz split, so be sure to use a radio capable of the odd split.

During voice activity, if the ham-astronaut appears to be engaged in a

scheduled contact on 145.55 MHz wait until the QSO is complete. It's better to get a QSL for a "heard" contact than to interfere with a school or family pass. Special QSL cards that differentiate between SWL and QSO activity are no longer printed.

### Making Contact

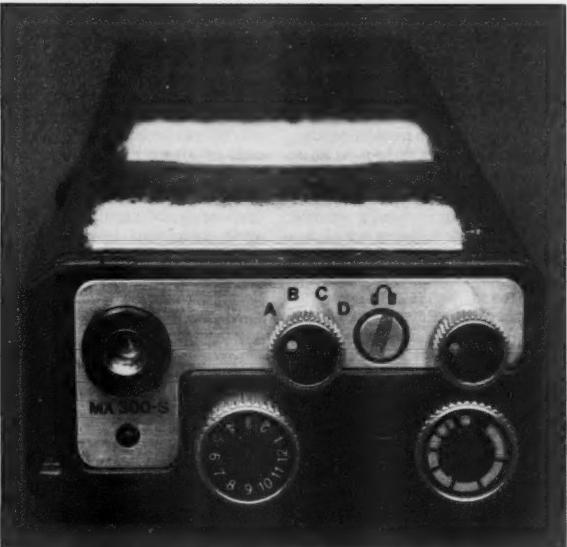
Using the rules above as a starting point, there are many ways to increase your chances for a good contact, or at least hearing SAREX activity to qualify for a SWL QSL.

If you are using a directional antenna you need to know where to aim. A computer with a good tracking program that can handle orbital decay data is the best approach. Several programs are available through bulletin boards for free or as shareware. Some of the best programs are sold by AMSAT, the Radio Amateur Satellite Corporation (850 Sligo Ave., Silver Spring MD 20910; telephone: 301-589-6062).

Accurate orbital data is needed to give the program information to locate the shuttle and determine antenna pointing angles for your location. This data is commonly referred to as element sets. Due to the high and variable decay rate of the shuttle's low orbit, current element sets are a necessity. They can be found on packet radio bulletin boards, CompuServe, the Dallas Remote Imaging BBS (214-394-7438), the AMSAT BBS (201-261-2780), SPACELINK BBS at (205-895-0028) or from WA3NAN at the Goddard Spaceflight Center. WA3NAN operates on several HF frequencies during missions including 3860, 7185, 14285, 21395 and 28650 kHz. Most flights require accurate tracking data not more than two days old for accurate antenna pointing. If an omnidirectional antenna is used it is still a good



Photo A. Typical configuration "C" for SAREX voice and packet. (NASA photo.)



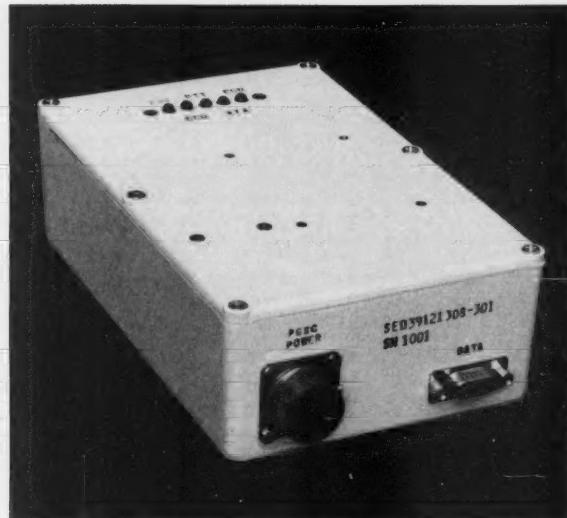
*Photo B. End view of the Motorola SAREX HT shows channel selection knobs and other controls. (NASA photo.)*

idea to know where the shuttle is located in the sky.

If you are aiming the antenna with an autotracking computer system, set the computer time exactly or slightly ahead, depending on how often the system updates the antenna position. For those with manual control, lead the shuttle by 30 seconds to a minute

to allow time for typing or calling as the spacecraft travels through the center of your beam pattern. Keep this up for the duration of the pass.

Be ready for voice or packet operation. The passes are short, usually about eight to 12 minutes. Antennas should be pre-aimed, receivers set to 145.55 MHz and transmitters set for



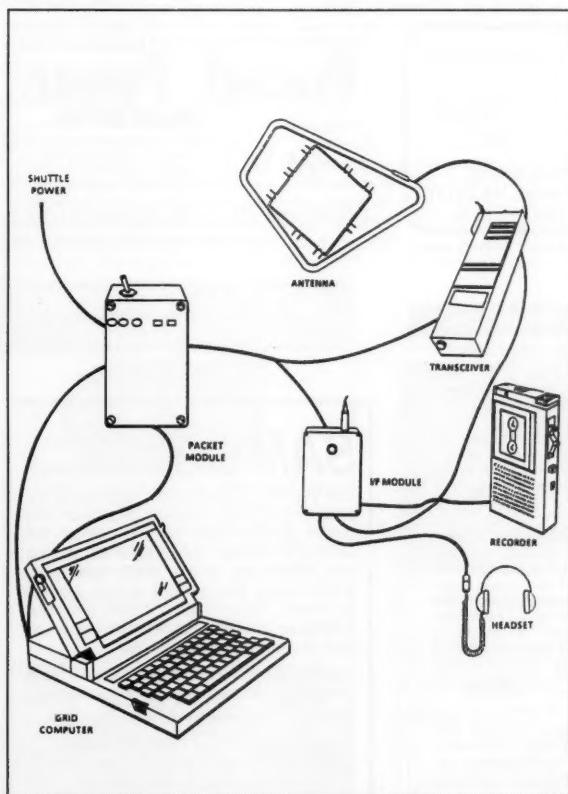
*Photo C. Repackaged Heathkit TNC for SAREX operation. (NASA photo.)*

144.49 (packet) or 144.95 (voice).

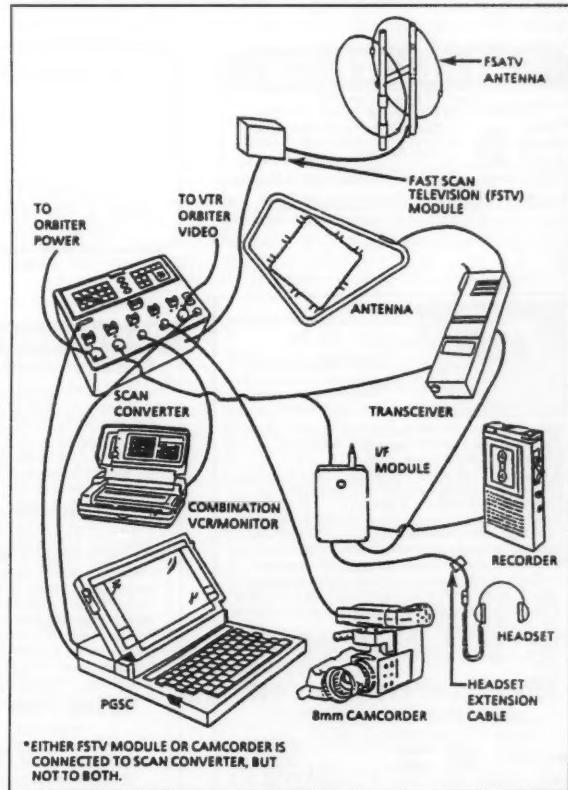
Additional frequency correction can be dialed in for Doppler shift. When the shuttle is approaching on a high-elevation pass, the received signal will be a few kHz high, so listen around 145.553 MHz. If possible, the transmitter should be set a few kHz low. This will center your signal in the receiver

on board the shuttle. When the shuttle is at its closest approach, there is no apparent Doppler shift so set both frequencies as listed. As the shuttle heads away, transmit a few kHz high and receive a few kHz low.

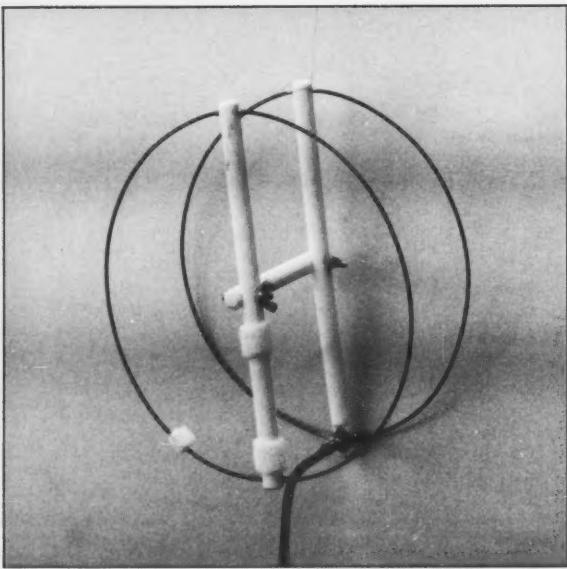
For packet operation set RETRIES=0. Many calls may be necessary to get through, and a timeout is



*Figure 1. Pictorial of configuration "C." (NASA drawing.)*



*Figure 2. Pictorial of SAREX system used on STS-56 for voice, packet, SSTV and FSTV reception. (NASA drawing.)*



*Photo D. Prototype of SAREX 70cm loop yagi for FSTV reception.*

inconvenient. Other parameters may be adjusted for faster and more aggressive operation. Check the TNC (Terminal Node Controller) manual and experiment. If the SAREX TNC hears your call it will respond. Your system will register the connect and hopefully receive a QSO number. Your system

will then "ACK" back to the shuttle. The SAREX TNC will register the "ACK" and send a disconnect packet. Your system will respond and show "DISCONNECTED." If all goes well, your call will show up in the "QSL" list with a QSO number. If the complete contact was not successful, your call will be in

the "QRZ" or heard list. The SAREX TNC can capture and hold 650 stations in the "QSL" list, but only a few dozen in the "QRZ" list. It is up to the laptop computer on the shuttle to collect "QRZ"-list data. Be sure to capture the data in your own machine for confirmation later since there is no guarantee that the SAREX laptop is on and collecting data. Beacon packets with the latest lists are sent every two minutes by the SAREX TNC.

For a voice pass use 144.95 MHz as the default uplink. Most operations on STS-56 and STS-55 earlier this year used this frequency. It is 600 kHz below the downlink on 145.55 MHz and can be used on all 2 meter FM rigs with standard repeater offset capability. Once again Doppler correction helps. If other stations are making contacts with the shuttle using the alternate uplinks (145.91 MHz, etc.)—try them. If the QRM on 144.95 MHz is fierce, the ham-astronaut will likely listen for signals on one of the other uplinks.

If you have an amplifier, use it. For packet, make one good contact and quit. The same goes for voice. Hundreds of stations are calling and multiple contacts or attempted rag-chewing won't help. A few hams have been known to make as many packet connects as possible for several passes. This inconsiderate activity makes it hard or impossible for everyone else.

It's a good idea to monitor as many

passes as possible, even after a successful QSO, just to practice antenna aiming and frequency tuning. The next shuttle flight might not be as easy.

If no activity is heard on 145.55 MHz, tune around. Scheduled contacts with schools or home may be taking place on unlisted downlinks. Early in a mission most passes are set aside for schools. Just listening to the astronauts' answers to questions from the school children is exciting. These kids may be future scientists, hams or even astronauts who got their first inspiration from the direct interactive conversation with an astronaut via SAREX. Don't even try to call if the downlink is not on 145.55 MHz. The SAREX Motorola HT uses much different uplink frequencies for these downlinks. The radio has 48 "channels" defining specific uplink/downlink pairs.

When a shuttle mission goes for an extra day due to bad weather at the primary landing site, or to allow more scientific studies, additional ham activity is common. The scheduled contacts are usually done and the ham-astronauts may have time for just "playing with the radio." A lot of good contacts have been made this way. The "big-guns" have made their contacts and are off chasing other DX on HF. Stations with less power or smaller antennas can usually get through with these conditions. Mobile stations and even those with HTs have had success. It's worth a try.

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# RTTY LOOP

Number 17 on your Feedback card

Marc I. Leavey, M.D., WA3AJR  
6 Jenny Lane  
Baltimore MD 21208

With all the traditional hoops and hollers, I am happy to inform all of you that this column marks the beginning of the seventeenth year of "RTTY Loop." Believe me, it would not be possible, it would not even be thinkable, without all of your support.

In that regard, I appreciate the recent messages from Richard J. Molby and Tom Vicinanza (both via CompuServe), with their words of encouragement. Tom is looking for hands-on help in the Orlando area; help get his RTTY machine online. Any takers?

Another CompuServe junkie, George F. Franklin WØAV, is looking for software to interface a TRS-80 Model 4 with a KAM TNC. George is one of a number of us who upgraded his business computer and is looking for a use for this otherwise-good orphan. Well, other than a modem communications package, I have no specific suggestions. Again, is anyone out there using such a combination?

That's the thing with RTTY—folks are always finding new ways to use old devices. For instance, Roger Owen WD8DJR of Eaton, Ohio, says that at one time he had an AEA PK-64 on RTTY, without much success. A short while ago, though, he found a used AEA CP-1 Computer Patch for a very good price and made the purchase.

The CP-1 seems to be a very good RTTY modem, and I interface it with my Commodore 64 computer, which the CP-1 was designed for. So I have made a few RTTY contacts, but I can't say that I find much activity on any band.

"Twenty meters seems to be the most-used RTTY band but, of course, it fades out when I have the chance to

## Amateur Radio Teletype

get on the air. (Isn't that always the case, no matter what mode?)

The main objective in writing to you is that for those of us who can't afford a super whiz bang megabyte computer, with all the bells and whistles, and a RTTY unit with even more bells and whistles, I find the AEA CP-1 and Commodore 64 hard to beat. The problem I find, though, is that the CP-1 seems to be as scarce as hen's teeth.

"I use the CP-1 with a Kenwood TS-530S, and it seems to do the job. When I tried RTTY before, I found that the '530 did not have good filtering, so it was difficult to copy, mark, and space signals on RTTY. With the CP-1, the filtering is already built in. Hot dog, I'm now on RTTY!"

Roger's success should be a lesson for all of us. You don't need the latest and greatest to get onto RTTY. I know I have been saying this for quite some time, but it's a message worth repeating.

Some solve problems, others pose them. Henry Fales, Jr., of Orleans, Massachusetts, writes that he has "a friend who is a confirmed satellite QSOer. This guy has very elaborate radio equipment but is using a C-64 for tracking and decoding. Until now, the bit rate has not exceeded 1200 baud, so he has been able to get away with a C-64. Soon, however, things are going to change. The new packet satellites will operate at 9600 baud, and my friend will have to change computers."

This person will not use a computer for anything other than amateur radio. Therefore, I would like the changeover to be as inexpensive as possible. Is it possible that a Commodore 128 could read and write ASCII at 9600 baud? If this were possible, I believe that he might be able to continue to use his disk drive and printer.

I feel certain that an Amiga A500 could do it, but I hesitate to recommend a computer which is now an orphan. Please roll this around and let me know what you think. Perhaps there are readers of the column who are facing the same choice."

This is a problem with many low-end computers, Henry. The Radio Shack Color Computer is in much the same boat, with a significant upper limit on the speed of data communication. Personally, I would think you should be able to get an inexpensive PC compatible to serve, particularly if nothing too demanding is required of the thing. A used XT-style machine shouldn't set you back more than a couple hundred dollars, and might just include a hard drive, software, and other goodies. Shop around, and don't be surprised at what might be sitting in someone's basement.

Finally, here's a letter from Steven Petrecz N5WKL of Bossier City, Louisiana, asking a simple question that has a complex answer. Steven says that he is interested in starting to monitor RTTY on HF, and transmitting on VHF. He is in the process of building the FSK demodulators that are described in the Tab Books' publication *1001 Electronic Circuits*, and he wants to build a video display, or "glass teletype," such as the HAL RVD-1005. He says that he does not want to use a computer as he feels he cannot justify such a purchase at this time.

Steven is looking for articles, books, and sources for parts for such an endeavor. No novice to construction, his ultimate desire is to build a basic solid-state RTTY station without having to resort to a computer.

At this time, this month, a complete answer to your question is really beyond the scope of this column. Over the past several years, several such terminals have been described in the pages of *73 Magazine*. A search through the *73* index will show some built from discrete chips, and others from integrated circuits. There really are many ways to

skin this cat. The reason more of these circuits are not published now is that simple, cheap, and readily available used computers work better. However, that is no reason to abandon the older technology, if that is your preference.

So, if there is some demand for it, I'll see what I can do about abstracting or serializing a project like this. I hesitate to do it if there is only very limited interest, but I will gladly dive in if some of you let me know that you would like the information.

Remember that readers of "RTTY Loop" continue to have access to the vast collections of PC-compatible amateur radio programs. RTTY and amateur radio programs are in collections #1, #2, and #4. Collection #3 is a bunch of archiving and utility programs for both DOS and Windows. Each collection will fit on a 1.44 Mb, 3.5" disk. One or two programs may be lost trying to cram them onto a 1.2 Mb 5" disk, and you will need to send a whole bunch of low density disks, if that is your system requirement. Anyway, for any or all of the collection, send me sufficient media, a return mailer with sufficient postage affixed, and \$2 in US funds for each disk to be filled, to the above address. I am trying to turn these around within a few days so, if you have sent me a disk or disks and haven't heard in a reasonable period of time, drop me a note or an E-mail message to make sure I received the original package.

We'll try to get a schematic in next month for those of you with solder to spare and a hankering to strip some wire. One thing about this column, folks, is that you never really know in what direction we will go. Be sure to share your thoughts with me via mail at the above address, CompuServe (ppn75036,2501), Delphi (username MarcWA3AJR), or America On-line (screen name MarcWA3AJR). During our seventeenth year I will continue to address your questions and concerns about digital communication, from RTTY to computers, here in *73's* "RTTY Loop."

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# HOMING IN

## Radio Direction Finding

**Joe Moell P.E. KØOV**  
P.O. Box 2508  
Fullerton CA 92633

### A "Swiss Army" Foxbox

Hams who enjoy hidden transmitter hunting are some of the most creative people I know. Not only do they delight in finding devilish hiding places for "T-hunts" or "foxhunts," as these contests are called, but they are also creative in choosing and using radio direction finding (RDF) equipment.

"Homing In" regularly features hams who are pioneering new RDF devices and techniques. This month, the spotlight is on Marty Mitchell N6ZAV and Byon Garrabrants KD6BCH. If it's the second Tuesday or first Thursday evening of the month, Marty and Byon will probably be competing in the informal 2 meter "progressive" hunts in Orange County, California.

One participant starts a progressive hunt by activating his hidden T at 7:30 p.m. The first person to find it immediately sets out in search of another hiding spot and puts T #2 on the air about the time the last hunter finds T #1. Now everyone else, including hider #1, looks for T #2. The first finder of #2 goes out to hide T #3, and so on. The hunt continues until about 11 p.m., or whenever everyone decides to quit and head for a coffee shop.

Progressive hunts, sometimes called "leapfrog" hunts, are great practice for rapidly tracking down jammers and QRN sources. In order to participate you need your own RDF gear, plus a rig to hide when it's your turn. Since more than one fox may be active at a time, each should transmit regularly for only a few seconds, then be silent.

Marty and Byon set out to design an easy-to-use tone source and transmission cycler. Marty started with the versatile 8-bit HCMOS Motorola MC68HC705C8 microcontroller IC, which has on-board 8K ROM, 304-byte RAM, and I/O ports. He added ICs for RS-232 interface, tone decoding, and audio switching. Byon began writing the software.

Before long they had created a device that they decided to market. It is more than just a foxbox. It's a multi-function radio controller—hence its name.

### The RaCon 6805

All you need to be the quarry for your club's next foxhunt is the RaCon 6805, a transceiver (mobile or handheld) for the hunt frequency, and a command transceiver (Photo A). You trigger RaCon to start transmitting or change its transmission sequence with dual-tone (DTMF) digits from the command radio's keypad. An intermittent-signal fox can be commanded on the hunt frequency by connecting RaCon's control input to the external

speaker/earphone jack on the hidden T.

Your callsign is permanently programmed into the microcontroller's ROM, as are nine transmission modes. They include three distinctive tone patterns and six on/off sequences, with transmit times from five seconds to four minutes. Dead times range from five seconds to one minute.

Preferences for foxhunt transmission sequences vary greatly across the country. For instance, in Southern California 15 to 30 seconds on, followed by an equal off period, is a popular mode. In some Midwestern and Great Plains states there aren't any big hills to reflect 2 meter signals or woods to conceal transmitters. To make the hunts more of a challenge there, rules often allow several minutes between fox transmissions.

To prepare for national distribution, Byon upgraded the firmware to accommodate these various local customs. In version 1.01, transmission mode #2 is user-programmable. With commands from your DTMF pad you can make its key-down periods as long or short as you want, with dead-time breaks from 0 to 15 minutes.

Mode #2 encourages you to unleash your creativity. You can use one or more of the ROM-programmed tone sequences, or invent your own. Key in up to 40 digits, each representing one of 16 tone pitches, and tell RaCon how rapidly to play them. With the right command sequence, RaCon will simulate sounds such as ringing telephones. Pseudo-random tone patterns are also on the menu.

Want to loan your RaCon to another hider? It's easy to change callsigns with a DTMF command. Worried about someone else accidentally or deliberately commanding your foxbox? Lock it with a DTMF command and RaCon will not respond to further commands until it hears its unique unlocking security code. (You cannot change the security code, so be careful about giving it out.) FCC rules prohibit auxiliary control links below 222 MHz, so if you're using the RaCon with a 2 meter transceiver, you must stay close to your hidden T so you'll be in "local control."

If you have a dual-band rig, the possibilities become more interesting. RaCon has a duplex mode, so you can command your dual-bander on 70 or 125 centimeters while it transmits on 2 meters. You can even play ventriloquist and talk through the hidden transmitter on the control link from your remote observation post.

By selecting the proper jumper configuration on the board, RaCon goes into the simplex or duplex fox mode when you apply power. Other jumpers select the proper PTT connections for various brands of handhelds and mobile rigs. RaCon requires +7 to +35

VDC at 33 milliamperes. Reverse supply polarity protection is provided.

### Wait, There's More . . .

RaCon doesn't have to sit on a shelf between T-hunts. It has additional features that are useful around the shack. With a change of board jumpers or a command from your computer it becomes a DTMF decoder, a remote controller, a CW keyer or an automatic pager.

When someone makes a call on your local autopatch without identifying, you might be able to tell if it was a bootlegger and identify the culprit by decoding the number dialed. The RaCon board, connected to your computer's COM port, will do it. Digits received by RaCon's DTMF decoder IC are processed by the 6805 and sent to the computer in ASCII at 1200 BPS for display. In my tests, the SSI202 decoder had a wide audio level range and good performance even with noisy signals.

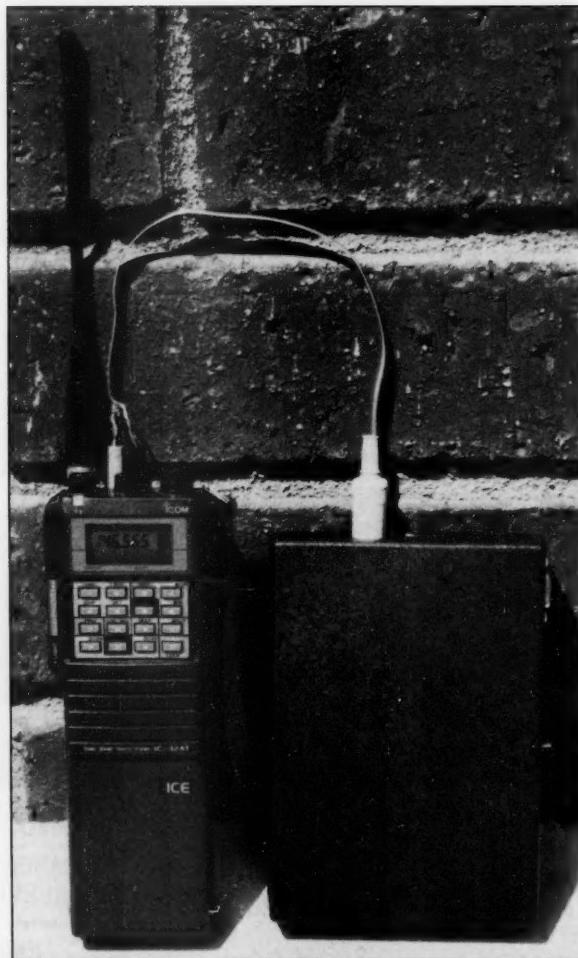
If you have an application for remote control by DTMF, you could write a PC

program to use the RaCon's ASCII output. For even more versatility, Byon has included a DTMF controller mode with eight CMOS output lines on the data port. Tone commands set or toggle each bit individually. Return telemetry is provided.

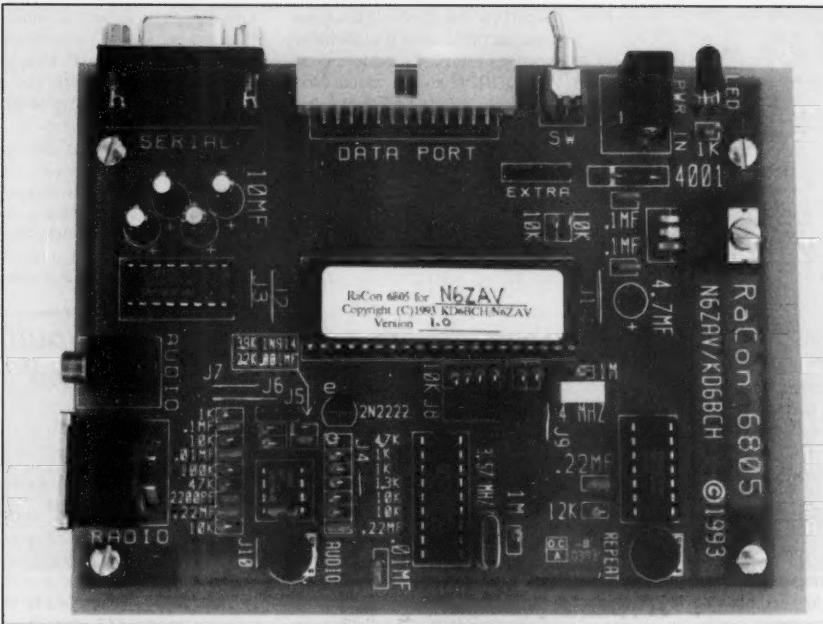
The CW keyer function is useful for remote telemetry projects. RaCon converts ASCII letters and numbers from its RS232 port to MCW into your transceiver or an audio amplifier. Automatic push-to-talk keying during code transmission is included. You can set CW speed from 5 to 25 wpm with computer keystrokes.

With a one-line buffer, you can type ahead and have good-sounding code at 13 to 25 wpm. But if you use this feature to teach slow-speed Morse in your club's class, you'll have to time the character spacing yourself because Farnsworth letter spacing is not included. Byon plans to add it to a future upgrade.

The auto-page feature allows you to initiate telephone paging via radio with a five-character DTMF command.



**Photo A.** The RaCon and a dual-band handheld with high-capacity battery make a complete remotely-controlled station. Progressive hunt enthusiasts have found these foxes hidden in hedges, tethered in trees, and buried on beaches. (Photo by KØOV.)



**Photo B.** The RaCon 6805 circuit board measures 4" x 5-3/8" and mounts in the cabinet of your choice. Timing is crystal-controlled, so two or more foxes can go on and off in sequence, staying in sync for hours. (Photo by N6ZAV.)

RaCon stays at your base station, connected to a transceiver and a 1200 BPS telephone modem with the X4 result code set. By your radio command from the field, RaCon tells the modem to dial one of four pager numbers and send one of four messages to the receiving beeper.

RaCon ID's back to you via radio that the page command was received. You can command it to beep your own pager to verify that your page was successfully sent. Enter pager and message numbers into RaCon's memory with your computer and COM port. You cannot reprogram the four pager numbers and messages from the field via DTMF.

This would be a great use for your old 1200 BPS modem. (Doesn't everyone use at least 9600 these days?) I couldn't test this feature with my modem because it's so old it doesn't have X4 result codes. However, I know it

works because N6ZAV and KD6BCH regularly page each other on T-hunts using a RaCon and modem at Marty's house.

## **Three Hours Well Spent**

RaCon is available in kit form only. Assembly instructions are minimal, but parts are easy to identify and component locations on the board are well-marked (see Photo B). Sockets for ICs are included, so you can test the board before IC insertion to accommodate firmware upgrades.

The unit that I tested had been assembled by N6ZAV. To get an independent view of the kit version, I questioned Mike Musick NØQBF, who bought one for T-hunts in St. Louis, Missouri. "As a fox, it's marvelous," he wrote back on CompuServe. "It went together in about 90 minutes, but I'm an experienced board stuffer. I'd guess that it would take a ham with more con-

vventional background about two and a half or three hours." Mike built his board into an aluminum box with a Yaesu FT-411E handheld and two 1.2 ampere-hour batteries. "I field-tested it with a friend yesterday and everything worked fine," he wrote. "It came right up with nary a hitch, took commands the first time, cougged up the chosen cycles right on cue, and went on its merry way. Very, very clean operation."

It was hard to find anything negative in Mike's assessment of RaCon, but he had one suggestion: "Connectors and controls are on adjacent edges of the board, so it makes a poor fit in typical aluminum boxes with U-shaped walls. I would have preferred all the connectors on one end."

The RaCon 6805 kit, including circuit board and all components, is available for \$79 from Marty Mitchell, 340 Otero, Newport Beach CA 92660. Add \$3 for shipping. As usual, this offer is

not guaranteed by *73 Amateur Radio Today* or by me. You must supply cables and cable connectors for your radio and computer.

The RaCon is truly a "one-gadget-does-almost-everything" device. However, it has a few important limitations. RaCon performs only one function at a time. For example, it will not do DTMF controlling and CW keying at the same time. Select your mode with computer or jumpers at turn-on; cycle it off and on to change modes.

RaCon has no EEPROM. User-programmed callsigns, tone sequences, page numbers and so forth are lost when power is removed, and it reverts to ROM defaults. If you need user programming, be sure to provide battery backup to cover momentary power interruptions. A 9 volt transistor radio battery works fine for this.

When talking through your hidden transmitter in duplex foxbox mode, remember that the fox's carrier remains on until you command it off, since there is no COR and no time-out timer. Be sure to include a CW ID cycle in user-programmed tone sequences. (It is automatically sent in the ROM-programmed modes.)

RaCon, like all digital devices, has the potential for radio interference (RFI), both incoming and outgoing. I found that RF from a hand-held scrambles RaCon's brains, but only if the antenna is within inches of the unenclosed board. Putting the board in a shielded metal case should prevent RFI problems.

Marty is upgrading the 14-page instruction manual to include troubleshooting information and more detailed descriptions of the various modes. N6ZAV and KD6BCH are giving good telephone support to RaCon builders. They seek user ideas for improved and expanded RaCon functions.

Heard of a new product for T-hunters? Let me know about it so "Homing In" can review it. A T-hunting Buyer's Guide installment of this column is in the works for later this year. Write to my Fullerton address above or send E-mail via CompuServe (75236,2165) or Internet (JoeMoell@cup.portal.com).

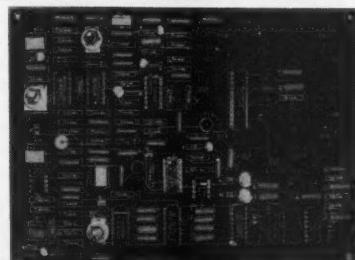
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# HAMS WITH CLASS

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## Having Fun With Youth Forums

Now that the Dayton '93 Youth Forum is one weekend behind me, I can look back with a great deal of pride at the outstanding job done by all the youngsters who participated in it this year. A youth forum is one of the most effective recruiting projects for a club or radio organization, but you must be prepared and be willing to put lots of time and effort into it!

To a large degree, the preliminary work spent on getting the children and the event organized will determine how successful it will be. When preparing for a national convention, you should begin soliciting for articulate and accomplished young people months in advance. Most of the amateur radio publications will be happy to help you get

the word out if you give them enough advance notice. You should also take advantage of local club newsletters and school publications.

When getting ready for something as big as Dayton (I'm not sure anything else is), you'll want to attract children who will be at ease speaking in front of a large audience. I have found the recommendations of local hams to be valuable. Very often, the children they recommend have friends who are also licensed amateurs. Getting the word out on local repeaters is another good way to let folks know that you're interviewing young people who are interested in sharing ideas with other children and lots of other interested ham radio operators.

Contacting amateur radio equipment manufacturers is another important step to take. Let them know on official stationery that you will be conducting a youth forum. Advise them of how many people you

expect to have attending the forum, and be professional in detailing what your goals for the forum are. Yaesu, ICOM and Kenwood, along with AEA, MFJ and others, have always been generous in donating gifts or handouts to be won by youngsters attending these forums. At Dayton, Yaesu donated a 2 meter handle-talkie for the drawing at the Youth Forum. Let's be sure to support the manufacturers who are supporting educational efforts.

help available. There's no need to reinvent the wheel. Anyone contemplating a new youth forum or teaching young people should leave your forum knowing what to do next.

It is extremely critical that you spend time conversing with your prospective speakers at length. I try to get at least two phone conversations in before I make decisions. It's true that there is no fool-proof way to guarantee that a child

**"Anyone contemplating a new youth forum or teaching young people should leave your forum knowing what to do next."**

Next, it would be a good idea to contact the ARRL Educational Activities Department. Either Tracey or Rosalie will be happy to send you materials that you can distribute to interested teachers, instructors, and recruiters who will undoubtedly be attending the forum. Be sure to emphasize to prospective amateur radio teachers that there are lots of materials, books, curriculum packages and

won't get nervous or freeze up in front of a crowd, but you should be able to get a good handle on who is articulate.

Since all your speakers will probably be under 18 years of age, you should make it a point to introduce yourself to their parents. In many cases, parents will not be attending the convention and you will become the contact person for their child. Have all the information

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CIRCLE 12 ON READER SERVICE CARD



*Photo A. Some of the 1993 Dayton Hamvention Youth Forum speakers. Left to right: Rusty KD4GLC, Alex N9KYJ, Shauna N7NGT, Mike KB8LCC, Matt KC6VIM, Luke KO4IQ, and Eric KB0KQF.*

available for them, such as possible airline discounts, hotel recommendations and other transportation arrangements. Many conventions offer the speakers free admission, banquet tickets, food scrip, or

other amenities. Check it all out ahead of time.

Make a check list ahead of time to anticipate the audio-visual needs of your speakers and yourself. Double- and triple-check with the

convention forum liaison person that all the equipment necessary for the youth forum will be available. Don't forget to check out the equipment ahead of time on the day of the forum.

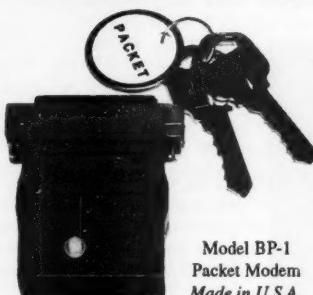
Prepare a list of all the children's names, callsigns, addresses, and a brief summary of their accomplishments. This should be handed out to the audience members so that interested people can contact the youngsters if they wish.

I always make it a point to call everyone involved with the forum a week ahead of time just to make sure there are no last-minute hang-ups. You might feel more comfortable if you have each child supply you with a copy of his or her presentation. When you call them for the final time you can offer suggestions about what they plan to say. Make sure that the speakers understand what you are trying to achieve with the forum. One of my main goals is for non-ham children to attend these youth forums and listen to upbeat and enthusiastic youngsters relate what it is that they enjoy most about amateur radio.

There's lots of work and preparation involved in organizing a successful youth forum, but it's worth every minute to be part of a well-spoken, highly accomplished group of youngsters who are indeed the future of amateur radio.

Be sure to come and say hello at my next youth forum. ■

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### The Ten-Tec Argonaut 509

Several months ago I described a home-brew classic, the Two-Fer. This month we'll look at another classic—the Ten-Tec Argonaut 509.

Even though this radio is slowly showing its age, it continues to be heard on all the bands, with the exception of the WARC frequencies. It has both SSB and the famous Ten-Tec QSK keying, making it a sought-after rig at hamfests.

One of the local hams called and asked me if I could look at his 509 because it would not transmit. After a few minutes on the phone to make sure that there weren't any misplaced wires or connections, we made arrangements for him to bring it over.

Since I have a 509 in my shack, I simply swapped out the plugs and connectors and replaced my rig with his. Turning on the power and setting the band switch to the proper position quickly proved that the receiver was very much alive and well. Several more minutes of knob-twisting proved that the receiver worked on all bands. So, switching over to the dummy load, I turned the mode knob to tune and adjusted the RF power control. Sure enough, the output meter just barely moved with the gain control fully clockwise. Yup! The transmitter was dead. Just to make sure the

problem was not only on one band, I tested the rig for transmit on all bands. Again, the RF output meter just barely inched up, telling me that the transmitter was indeed dead. Off to the testbench we went.

#### Fixing an Argonaut 509

The Argonaut 509 is easy to work on. You'll be flipping the 509 back and forth, so place something soft on your work surface to protect the case from scratches. A heavy bath towel works very well. Most of the case parts come apart to allow you access to the insides.

**"Under no circumstances should you try to adjust the sealed coils (T1 and T2) on the receiver front end."**

Start by removing the top case. There are two screws on the back holding the case top to the back panel. After the screws have been removed the top slides off. A small metal bracket holds the speaker to the top case. Release the speaker by removing the screw holding the speaker. The speaker will still be connected to the audio jack so be careful that you don't pull the wire either off of the speaker or out of the jack. After you remove the top, what you see is just the top half of the 509; the bottom is just about as full of modules.

The first thing to do is check for loose plug-in boards. When Ten-Tec originally installed the sockets for the plug-in modules they got a good batch. Unless you constantly plug in and remove a board, you won't see the socket wear out. I've never seen a bad socket in a 509. Still, let's not ignore what may be the obvious problem. The plug-in boards also have screws holding them in place. As I said, it's very rare to find a loose module in a 509, but check just the same.

The top half of the Argonaut 509 consists mostly of receiver boards and the control board. Looking down into the rig, with the front panel directly in front of you, you will see the control board on the right. On the left are the ganged tuned circuits for the front-end receiver; the low-level RF drivers for the transmitter are right under the cage.

*Under no circumstances should you try to adjust the sealed coils (T1 and T2) on the receiver front end. You must have the proper test equipment to align these coils. You can't do it by ear, and you can't align them by watching the meter. In two words, "DON'T TOUCH!"*

Without missing a heartbeat, I went directly to the PA, located on the bottom half of the 509. You must remove the bottom plate to get to the PA. There are several screws you must remove before you can get to the bottom of the rig. Notice what

screw goes where as which have machine threads and which are self-tapping. After the screws have been removed, slide the bottom plate off.

Right behind the large VFO box, toward the rear of the chassis, is the PA module. It's a plug-in module too, but the heat sink for the transistors is screwed to the main chassis. You must remove this screw to release the module.

I worked for a computer shop part-time fixing Apple computers way back when. Their service policy is outstanding. It went like this: "Try this . . . try that . . . replace the motherboard." So, having a second 509 at my disposal, the cheap and dirty way to check the PA was to swap it out with my known good unit. That's exactly what I did. After I tore apart my 509, I exchanged the PA modules.

Powering up the suspect rig, I plugged in a dummy load and flipped the mode switch to tune. Rats! I had just put in a known working PA module and there was still no power coming from the transmitter. So, not to be outdone by a simple problem like this, I installed the "dead" PA module in my 509, applied power, and the RF output meter swung up full-scale. It looked like the PA was good and there was something else wrong with the 509. Back to the testbench with another game plan.

The next step was to look for the proper T/R voltages. It's a simple test and requires only a VOM. Ten-Tec's manuals are very complete when it comes to voltage checks and circuit schematics for each module. All the needed T/R voltages are clearly listed. They are labeled "T" and "R" voltages on the schematics.

The T/R voltage must change when going from receive to transmit. It's a very sharp jump in voltage from less than 1 volt to about 10 volts. There should not be any voltage in between the two—it's either on or off.

Everything seemed to be fine, but since I had my 509 apart, why not switch out the control board. The control board generates the REF voltage for the VFO, along with the T/R switching voltages. This sounded good to me so I put my good control board into the dead 509. Again, no transmit with the new control board. I reinstalled the board I had removed from the dead 509 into my 509. It worked just fine. I then swapped the boards back, and guess what? My 509 wouldn't transmit. What started out as a simple fix had now killed two Argonaut 509s. For some people the birds sing!

Was there something in the rig that blew up my control board? Nah, the one I took out seemed to work just fine. But what could have killed my control board after I put it into the second rig? Well, first things first, and that meant fixing the transmit problem in the first 509.

I knew that the PA module was OK so lack of RF drive had to be causing the problem. The low-level drive comes from a non-removable PC

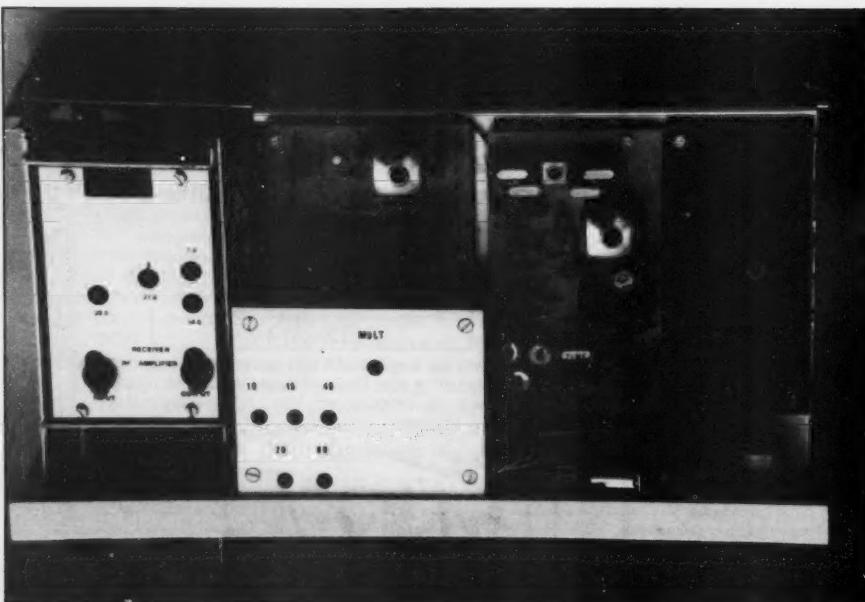
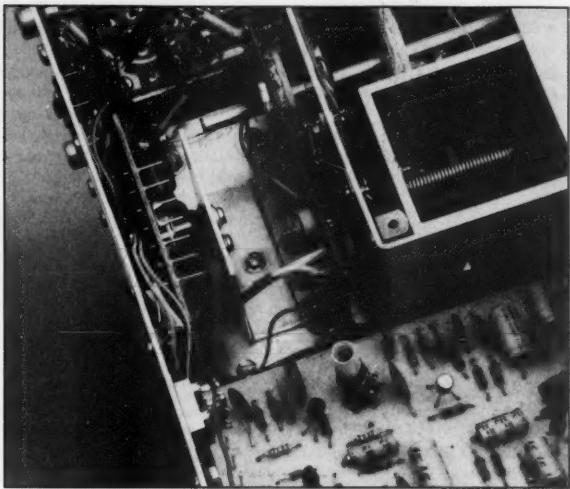


Photo A. Looking down from the top of the Argonaut 509. The right side of the photograph shows the control board. The large box in the center is the VFO compartment.



*Photo B. The PA heat sink is shown directly below the VFO compartment. Notice the screw holding the heat sink down.*

board deep down inside the receiver's front end. It's not easy to get to—this requires a major tear-down to accomplish. However, there is an easy way to check for proper operation of the low-level driver.

You'll need either an oscilloscope or an RF probe and VTVM (or high impedance VOM). Since both the low-level driver and the PA driver

transistors have their collectors connected to their cases, we can tell if there is any signal gain between the two. You'll need to remove the top of the receiver front end tuning cage. Be careful—you don't want to break any of the slugs or damage any of the coils. The cage will lift right off the top. Lay it aside for safe-keeping. Now, take your test probe

and touch the case of the low-level driver transistor. Set the scope to measure 0.5 volts peak-to-peak. Also, set your scope to read only RF and not DC voltage. Flip the 509 to transmit and slowly increase the drive control. You should see the RF voltage on the case increase. If you don't, that transistor or the stage feeding it is bad.

The next step is to leave the drive control where it is and move your test probe to the collector (case) of the PA driver. You should see a large increase in signal. Now, adjust the drive control and verify that the signal increases or decrease as you run the control through its range.

what? Four watts of RF into the dummy load. I still had no indication on the 509's meter, though.

And that's where we'll pick up next month; I'll finish the troubleshooting and tell you where the problem is and how to fix it.

If there is something special you would like to see here in the "QRP" column, please drop me a note. Perhaps we'll dig into a subject you would like to know more about. Who knows, we both might learn something when breaking new ground.

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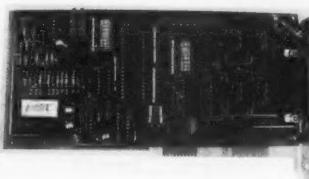
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## Simple Gray-Scale Generator

While at this year's Dayton Hamvention, I had the pleasure to meet with Mike Sheffield ZL1ABS from Auckland, New Zealand. He gave me a schematic of what has to be the simplest and cheapest source of video I've ever come across. Using just one CMOS logic IC, this circuit generates a beautiful gray-scale pattern which is perfect for adjusting monitors and TV receivers for proper contrast and gives you an inexpensive source of video for your ATV transmitter. This gray-scale generator is very compact and draws very little current—I used a 9-volt battery to power my circuit.

## How It Works

The heart of the gray-scale generator is a 14-bit binary counter IC with an on-board oscillator (see Figure 1).

As the counter increments, a stepped output voltage is generated, thanks to the voltage divider network connected to outputs Q4-Q6.

When the counter activates Q7, the circuit resets and repeats the sequence. This reset signal essentially divides the 1 MHz clock frequency down to the video horizontal line frequency of 15,625 kHz (European standard). Keep in mind that we are not generating vertical sync with this generator, just a stepped voltage that repeats at the horizontal scan rate. The end result is a series of continuous vertical bars that increase in brightness from left to right on your monitor.

## The NTSC Modification

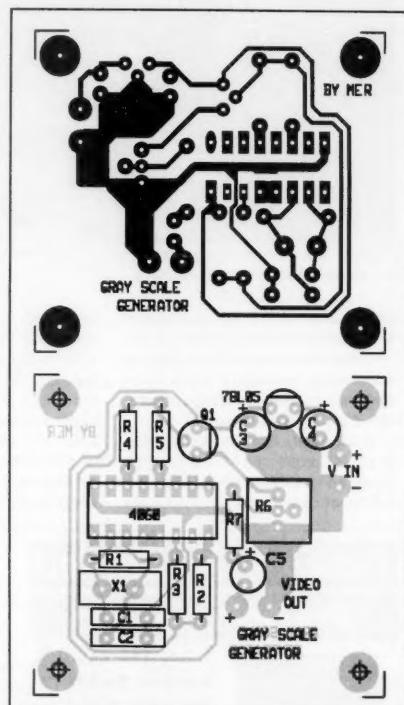
Since this circuit originally appeared in the British Amateur Television Club's magazine *CQ-TV* (issue #138, p. 34; and #145, p. 74—Figure 1 is ZL1ABS' modified version) it was designed for the European horizontal line standard of 15,625 kHz (625 lines of video at a 50 Hz rate). The U.S. horizontal line frequency is added a 5 volt regulator to provide a steady video level if the supply voltage varies. The voltage regulator is optional as the circuit will work with a supply voltage from 4 to

15,750 kHz (525 lines of b/w video at a 60 Hz frame rate). When using the circuit shown in Figure 1, you may have to adjust your TV set's horizontal hold to compensate for the different line frequency.

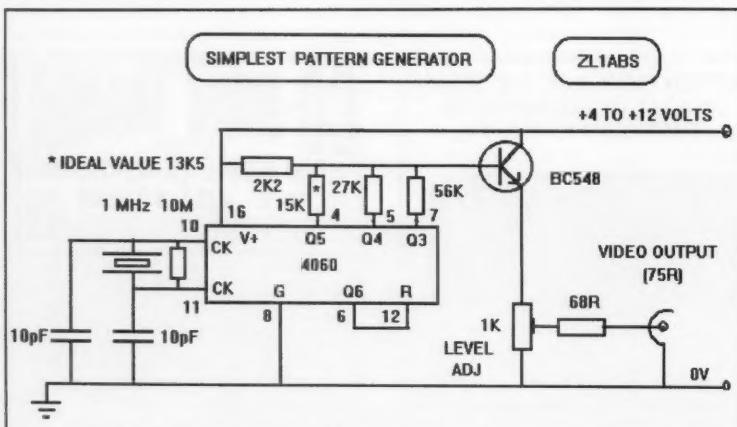
In order to generate a horizontal line frequency on 15,750 kHz, I searched the catalogs for an appropriate (and cheap) crystal. I finally found a 4.032 MHz crystal in the Digi-Key catalog.

12 volts. If you'd like to use this new circuit for European standard video, just use a 4.000 MHz crystal.

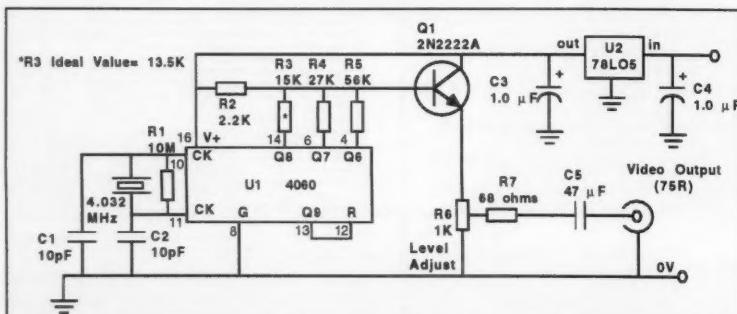
I hope you enjoy this unique generator. If you'd like to play with some variations of the gray-scale output, try moving the reset and voltage divider resistors to different divider outputs (i.e. instead of connecting them to output pins Q6-Q9, try connecting them to Q7-Q10).



**Figure 3.** PC board foil pattern and parts placement for the NTSC version of the gray-scale generator.



*Figure 1. The original gray-scale generator (European line standard). Modified by Mike Sheffield ZL1ABS from circuits appearing in CQ-TV #138, p.34 and #145, P74.*



**Figure 2.** The simple gray-scale generator modified for NTSC U.S. video output (horizontal frequency of 15,750 kHz).

Parts List for Figure 2			
C1,C2	10 pF capacitor	Digi-Key# P4837	
C3,C4	1.0 uF tantalum	Digi-Key# P2059	
C5	47 uF tantalum	Digi-Key# P2042	
R1	10 MEG resistor	Digi-Key# 10MQ	
R2	2.2k	Digi-Key# 2.2KQ	
R3	15k	Digi-Key# 15KQ	
R4	27k	Digi-Key# 27KQ	
R5	56k	Digi-Key# 56KQ	
R6	1k potentiometer	Digi-Key# 3386P-1K	
R7	68 ohm	Digi-Key# 68Q	
X1	4.032 MHz crystal	Digi-Key# X015	
Q1	2N2222A transistor	Digi-Key# PN2222A	
U1	CD4060B	Digi-Key# CD4060BCN	
U2	78L05 5-volt regulator	Digi-Key# AN78L05	

A blank P.C. board is available for \$3.50 plus \$1.50 shipping per order from FAR Circuits, 18N640 Field Court, Dundee IL 60118.

A complete kit including the P.C. board is available for \$15 ppd. from Elktronics, 12536 T.R. 77, Findlay OH 45840; tel: (419) 422-8206.

# NEW PRODUCTS

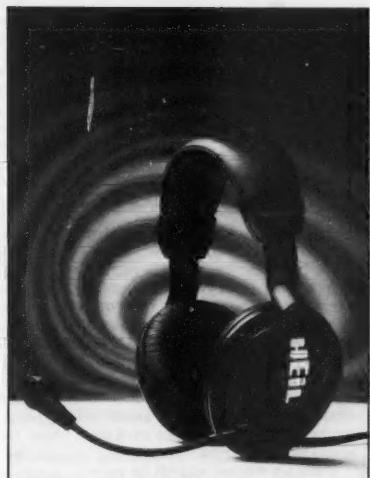
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## HEIL SOUND LTD.

The SA-1 (near right) from Heil Sound, a new compact sound system for amateur radio receivers, will allow operators to hear weak signals, sort out the rare DX, and hear audio quality never before available to radio amateurs. The unit contains a high quality 5 watt amplifier and a 4" broadband speaker working into a ported acoustic cavity. A variable equalizer is built into the amplifier, allowing the operator to adjust the audio for maximum articulation. The extended response, added efficiency and additional power output from the SA-1 will lower your noise floor, increase articulation and allow you to copy signals that used to be impossible to hear.

The new PRO-SET (far right), is another entry from Heil Sound's continuing line of products developed by and for the amateur radio market. The unique qualities of this head-



set/microphone make it particularly useful for multi-op contesting and DXpeditions. It has an adapter type cable to facilitate dozens of connector pinouts for various rigs. There are three different PRO-SET models, with differences in the type of microphone element used. The vinyl earpad ring mount snaps into the headpiece for easy removal for

washing or replacement.

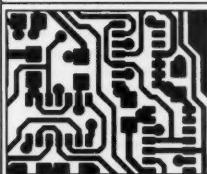
The headband is fully padded, with detent stops for each side. The unit is light but extremely rugged. The microphone boom is flexible and can be placed in just about any location, or can be folded up for traveling and storage.

The estimated retail price for the SA-1 is \$89.95; \$134.95 for the

PRO-SET. For more information, contact Heil Sound Ltd., Heil Drive, Marissa IL 62257; (618) 295-3000, Fax: (618) 295-3030. Or circle Reader Service No. 201 for the SA-1; Reader Service No. 202 for the PRO-SET.

*Continued on page 90*

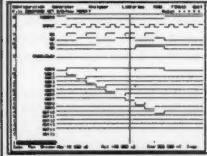
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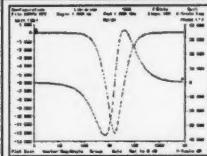
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### TWT Power Amplifiers

This month I will cover the microwave amplifiers called "TWTs," or Traveling Wave Tube amplifiers. TWTs are the high-powered amps that were used for the moonbounce operations described in last month's column. The 10 watt units that I present here are somewhat lower power than the 28 watt type used by Charles Suckling G3WDG, or the very high-power TWT used by WA7CJO. In either case, the principles are the same but the higher power units are more desirable for moonbounce.

TWTs are the real holdouts for vacuum tubes in this age of solid-state design. The 10 watt TWTs (5 and 10 GHz) in commercial market use have been replaced by solid-state designs. However, in surplus they are somewhat rare. The very high-power devices still have many applications today and are used for satellite transmission both on earth stations and in space.

This month I'll look into the letter file, which is getting deeper due to the fact that I have spent most of my time recently on duty duty—I've been on a case for about five months. Needless to say, this is taking a toll on my amateur radio activities, but I should begin to take up projects again in a few weeks or so. There are so many different projects that I want to get into, but without adequate time I can't do them justice. I'll get back on the ball very soon; please bear with me.

### The HP-491C

Jim N5TSP is in the process of building several stations for 1296, 2304, and 3456 MHz, using Down East Microwave transverters (check almost any issue of 73 Magazine for their advertisements). Jim writes that while he was in Southern California he ran across a Hewlett Packard HP-491C TWT amplifier rated at 1 watt output for 2 to 4 GHz operation.

He has several questions concerning the HP amplifier. First question: Do I know of anyone using these amps on 2304 and 3456 MHz? Well Jim, I do not personally know of anyone using this amp but that does not preclude it from working well for you in this application. I use similar TWT amplifiers and they work quite well. The amplifier you picked up was originally intended to increase the output power from Hewlett Packard

signal generators (max 0 dBm) to higher power levels up to 1 watt for power applications.

Different generators require separate TWT amplifiers for their respective frequency ranges. Drive power for the TWT to put full output power (of 1 watt) is 1 mW or 0 dBm. They will also work "as is" in the FM and SSB mode of operation. The only modification involved is switching. That is because the units were intended to be manually switched on and off by means of toggle switches.

Second question: Can the power output be pushed up if it's being used in an intermittent duty cycle? Power output depends on a lot of things in TWT amplifiers. This type of amp is self-contained, with the high voltage regulated power supply inside the rack mount cabinet. Output power depends on tube condition and the precise voltage (+/-1%) on each particular element. Power can be increased by making adjustments to peak operation at a particular frequency vs. broadband operation. I would not expect to get much improvement (such as doubling output power). You might get 1-1/4 watt output at best. I suggest you leave it alone unless you want to experiment. What you get initially is about all you will ever get unless the power supply is out of adjustment. A small percent error here can mean a large microwave power output error.

Question three: Does anyone have documentation or info on modifications for the HP amplifier? On this one I will have to wait for help from our readers. I'll keep my eyes open. Our local surplus store has several of these amps for 10 GHz, but no manuals or even a schematic. If you choose to tinker with the unit, be cautious because the power supply for any TWT amplifier uses voltages in the several KV range. True, the current can be low, but the voltage is quite high and that is not only dangerous but lethal.

I hope this answers several questions. As a matter of general interest, these TWT amplifiers came in a series of units like the 491-C. The model 489-A works from 1 to 2 GHz, the 493-A from 4 to 8 GHz, and the 495-A from 7 to 12.5 GHz. Each unit works on different frequency bands from 1 GHz to over 12 GHz. For a low price, these units can make a good mid-power amplifier unit for base operations. All units in this series are rated to 1 watt power output. (Note: Drive requirements of the TWT are near 0 dBm/1 Mw, making it drivable from a mixer or single-stage amplifier for

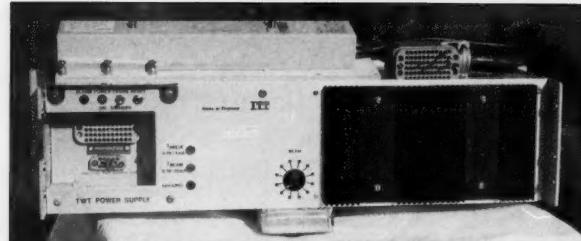


Photo A. 10 watt ITT power supply and TWT tube.

full output power.)

Many other manufacturers have made similar amplifiers. Hughes Aircraft made a similar unit to the HP-491, but these units are normally rated in the 10 and 20 watt level range. The TWT amplifiers that I am most familiar with are the ITT PV5C11C for the power supply, and the W3MC15C 10 watt TWT tube for 10 GHz. This unit is somewhat different; the power supply and tube are independent of each other and attach together by a single multi-conductor high voltage cable. A little terminology might be in order here. If the TWT unit is self-contained it is called an "amplifier." If it is separate (i.e.: the tube is separate from the power supply), it is called by its component part names even though it is still a complete amplifier in all respects when connected together.

The ITT system that I use requires a DC system that is positive ground, negative 24 or 48 volts for operation. The ITT units were made in England so only surplus quantities of these units appear in the US. Far more popular, though, are the Collins Microwave units which came from Richardson, Texas. (Note: This source does not exist today.) Collins made this unit for the telephone industry, in which negative 24 and 48 volts is standard power.

I have several of these working units, and a couple more dead ones I rob for parts. Needless to say, this is the unit that Kerry N6IZW and I use for our 10 GHz stations. Originally, this unit was made to work in the commercial band of 10.7 GHz to 12.7 GHz. No re-adjustment is needed to operate on 10.368 GHz. I expect a little degradation in output power due to the lower frequency, but for the most part I ignore it. (See Photo A.)

Another manufacturer of TWTs is Varian Electronics in San Carlos, California. I have some of their units, but no schematic details. They are quite similar to the ITT units (positive ground), but do not require internal changes for DC input voltage variations. Both the Varian and the ITT TWT amplifiers operate on the

10 GHz band and have an output power of 10 watts. (See Photo B.)

Another TWT manufacturer is Thompson CSF Electronics. The unit that I have is a 6 GHz TWT very similar to the 10 GHz unit in that both power supplies were made to operate on 24 or 48 volts and positive ground. The TWT is external to the power supply. Again, this is a 10 watt unit. The Thompson model number is TH-21543 RM (rack mount), with a TH-3543 TWT tube. (See Photo C.)

**Caution:** Please note that while the Thompson and ITT power supplies look alike, they are not interchangeable. All tubes are keyed differently. However, they all have the same type of plug mounted on the end of their short cables. Don't let this cause you to make a mistake and use the wrong power supply with the wrong tube. If you try this you are in for quite a disappointment. Tubes and power supplies are all different and each requires its own special arrangement.

Part of the problem is that each tube requires slightly different voltages on elements of the TWT tube. Additionally, some of the tube elements do not come out on the same pins for all tube types. This is to help prevent the wrong tube from being connected to the wrong power supply. In most cases, interlocks wired into the tube socket prevent the power supply from being activated. But, according to Murphy's Law, it could be devastating at the worst possible moment. If you see such amplifiers in the surplus market, make sure of what you are buying. It might look all right connected up to the external tube, but CONFIRM THAT THE TUBE AND POWER SUPPLY ARE FROM THE SAME MANUFACTURER. I can't stress that enough! See Figure 2 for the DC power supply connections for the units described here.

There are solid-state alternates to TWT amplifiers. These units can take the shape of something similar to the satellite amplifier that I described in the September 1992 issue of 73. There I de-

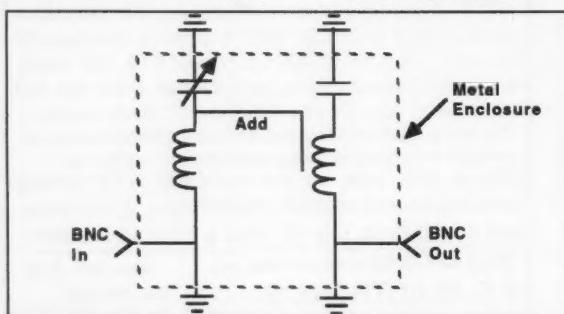


Figure 1. 2 meter filter and added coupling arrangement.

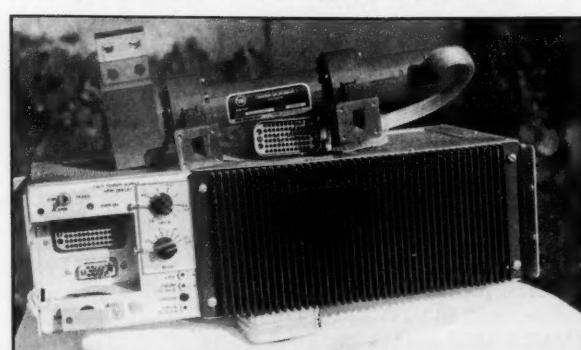


Photo B. 10 watt Varian power supply and TWT tube.

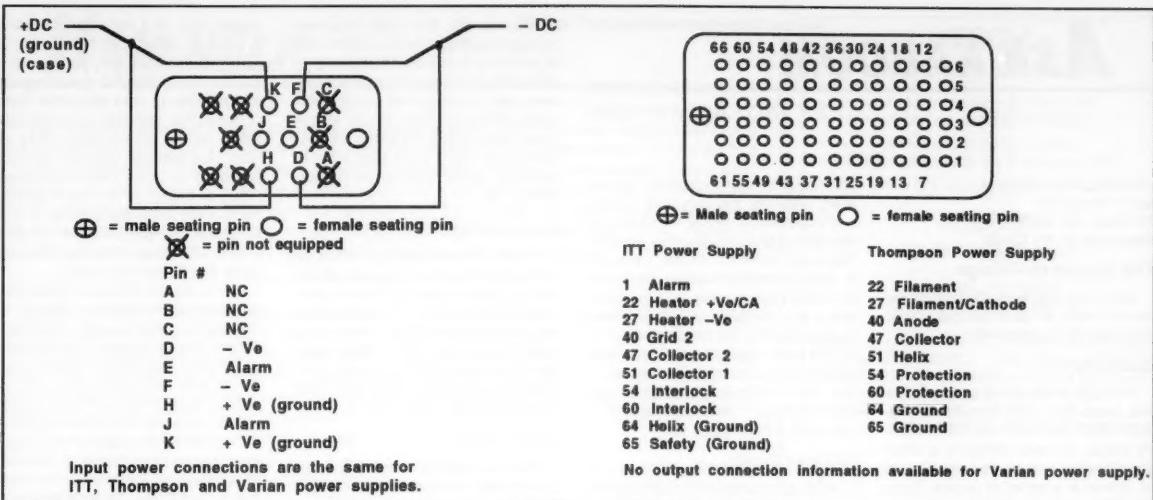


Figure 2. DC TWT power supply connections.

scribed converting a 1/4 watt solid-state amp from 14 GHz to the 10 GHz amateur band. I suspect that there will be quite a few devices similar to this unit, for many different frequency bands, showing up in the surplus market in the not-too-distant future.

Military surplus stores sometimes have some very good buys, but you'll have to really look carefully. If you're lucky you'll arrive just when the truck is unloading and get first shot at it. I've found several solid-state amplifiers, covering many different bands of operation. To date, I have gathered quite a collection of devices to aid construction of converters for several of our microwave amateur bands.

I consider some of these amplifiers as part of the class of hard-to-find materials I call "UNOBSTANUM." With military manufacturing in its current state of transition, I believe that there will be lots of new surplus material, including solid-state amplifiers. You've just got to keep your eyes open and keep a little cash tucked back in your wallet to take advantage of the opportunities when they arise. I'll get into solid-state amps next month.

Concerning the wallet, I was severely bitten by being \$20 short on a deal quite a few years ago. I don't think I will ever get over it. I missed out on a 2-cubic-

foot box full of RF power transistors at an auction due to 20 bucks! What made me so frustrated was that the material was in with some junk that went for peanuts and I was the only one who knew the devices were in that auction lot. I did my homework, but I didn't cover the financing. I have to chalk this one up to experience, for it taught me a very (expensive) valuable lesson. Oh well, you can't win 'em all.

#### Mailbox

Dominick N2LDJ states that he constructed two filters, the alternate spaced air coil and the variable capacitor filter (see "Filters for 2 Meters," "Above and Beyond," December 1992). "Although both filters work fine in removing intermod during receive, I can't tune up these filters on transmit. I am using an SWR/power meter to adjust and tune, but it appears that the filters on transmit are 'dead,' no power out. I have tried the methods to tune the filters as described in your article and have double-checked my connections, but still no luck. Help!"

Of course I will help. I believe that the spacing or coil-to-coil coupling might be too loose, meaning there's not enough coupling between circuits. As you state, they tune just fine on receive so the filters are peaking up in the receive mode. I suggest you add a coupling capacitor

between sections of the filters. This can be a small 2 to 3 pF capacitor, or even be a "Gimmick Capacitor." By gimmick capacitor I mean we form a capacitor out of a short piece of large diameter wire that is directly soldered to one of the tuned circuit's variable capacitor solder post and the insulated portion of this wire is brought in close proximity to the other coil. This, depending on position, will add the required coupling. See Figure 1 for a brief drawing detail on the added inner coil coupling.

Paul KBBCMW writes that I have provided lots of details on the Frequency West type of brick oscillators and covered some of the mods to these oscillators. "Do you have any information on the California Microwave bricks?" Paul states that he would like to get some information on modifying the filters. He is interested in tuning these filters for the 23 or 13cm bands. Paul is interested in any information on the retuning of this type of filter.

Well Paul, yes I have retuned these filters, but be assured these filters do not move very far from their original frequency. The lower the brick output frequency, the less the filter can be retuned. I use a rule of thumb that says most bricks can be retuned something like 5% of the original frequency. It's not exact, but in most cases it works fine.

On some rare occasions I have moved 8 GHz bricks to the 10 GHz range, but that is stretching the tuning to an extreme. All 8 GHz units will not tune that far, but some will.

I find it's better to retune, say, an 11 GHz brick to the 10 GHz range. This almost always works, except for broken or stripped or locked tuning screws in the filter, making readjustment impossible. To retune almost any type brick you have to determine which filter type you have. Frequency West has two types: one with lock nuts on Allen screws, and the other with Allen screws on top (no lock nuts). To tune the one with no lock nuts you have to remove the diode multiplier filter portion from the brick top. The lock screws are on top and the tuning screws are inside the filter opposite the side of the RF output connector. To make adjustments on this type unit, the filter is reversed and placed back on top of the brick in a somewhat unstable position. The RF probe is placed back in the hole for RF drive to the filter multiplier. When it is installed this way, access to the adjustment screws is very easy. When it's complete, reposition the filter back in its normal position.

The adjustment procedure for the Frequency West brick that has the lock nuts is quite easy. All you have to do is build a special tool to relieve frustration. Take a nut driver to fit the locking nut and drill a hole through the handle to accept a small brass rod. To the end of the brass rod drill a hole to fit the Allen screw on the adjustment screw. Use the tool to, in one motion, loosen the lock nut and make adjustments with the brass rod/Allen wrench. These screws are under the top blue label.

For the California Microwave brick the procedure is somewhat the same as for the Frequency West brick without lock nuts. Unfortunately, it's a little tougher. The problem is that part of the RF output connector has to be moved in order to reposition the filter back on the brick. This enables you to loosen the top lock screws and gain access to the internal filter screws, all of which are very small Allen-heads. Adjust the frequency in small increments.

As always, I will be glad to answer questions related to this and other topics. For a prompt response please send an SASE. 73, Chuck WB6IGP.

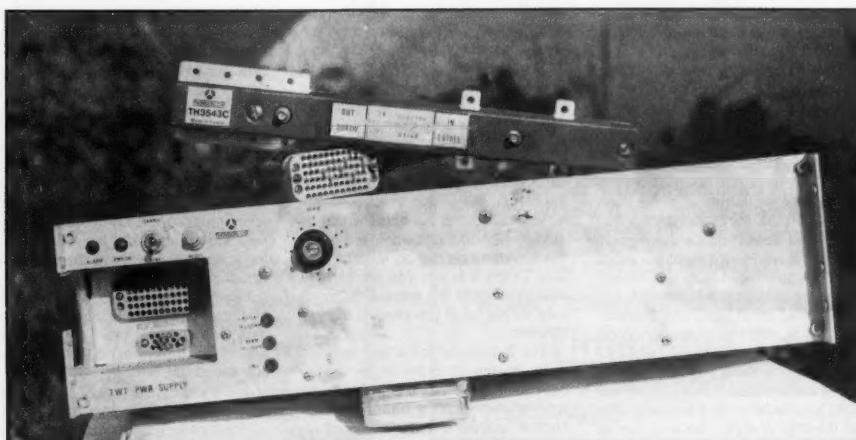


Photo C. 10 watt Thompson CSF power supply and TWT tube.

# ASK KABOOM

Your Tech Answer Man

Michael J. Geier KB1UM  
c/o 73 Magazine  
70 Route 202 North  
Peterborough NH 03458

## The Scope of Things

Last time, we were discussing the ins and outs of oscilloscopes. Let's continue where we left off.

### Double Vision

Why the heck would you want to see more than one waveform at a time? Well, as it turns out, it's incredibly useful. The basic structure of electronic devices is such that signals can be viewed in a series of stages. Each circuit stage does something to the signal inputted to it and then feeds it to the next stage. Some stages have several inputs, several outputs, or both. But the point is that any given stage changes the signal in some way. Perhaps it's a current amplifier. If so, it makes the signal carry more current so it can drive a bigger load. Or, perhaps it's a mixer. Then, it takes two or more input signals and produces a composite output signal.

A multiple-channel scope lets you see the input and output of a stage at the same time. Let's say you're looking at a voltage amplifier stage in the distorted audio amplifier of your 2 meter rig. The signal goes in and is supposed to come out the same, only bigger, right? So, you look at the input signal and, sure enough, it looks like audio. Then, you look at the output signal and, yup, it looks like bigger audio. So, the stage must be OK, right? Wait a minute. How do you know that the output's a decent replica of the input? Here's a great way: Connect one channel of your scope to the input, one to the output, and then turn the second channel's sensitivity down so that the waveforms are the same size on the screen. You should be able to superimpose them and they should look the same. If not, the radio's stage has significant distortion, which is just what you're looking for! (Actually, there's an even better way to use a dual-channel scope to find such a problem, and we'll get to it a little later.)

Another vital use for multiple channels is observation of the time difference between two signals. If, say, a circuit is supposed to delay a pulse by 15 microseconds, how do you tell if it really is working? By connecting one channel to the input and one to the output, you can actually measure the time difference between them. In fact, alignment of high-tech gadgets like VCRs and digital tape recorders is impossible without such measurements. And digital beasts like the frequency synthesizers in your radios often yield to such techniques, too. For that matter, any kind of phase shift or time delay can easily be seen and roughly measured.

### How Many?

It is possible to make scopes with

just about as many channels as you want. Naturally, the cost goes up with each additional channel. Although you can buy quadruple-channel scopes, they aren't common. In fact, there are 8- and 16-channel scopes designed for digital work, but they cost two arms and a leg. Besides, you really don't need something like that anyway.

The most common kind of multiple-channel scope is the dual-trace unit. In fact, the 50 MHz dual-trace scope is a staple of modern electronics servicing. Let's look at how to use one.

### I'd Rather Switch

Although some early dual-channel scopes actually had two separate electron beams in their CRTs, that was always uncommon, and it's unheard of today. Today's scopes have two traces, but only one electron beam. How do they do it? Just as you might expect . . . they fake it! There are two ways: One, the first trace is drawn and then the second, so fast that you can't see it happening. Two, the trace rapidly switches back and forth between the two traces, drawing bits of each as the beam sweeps horizontally across the tube. The first method is called an *alternate* sweep, and the second is called a *chopped* sweep.

Both methods work well, but each has advantages and disadvantages. Alternate sweeping becomes visible and annoying if the sweep speed is slow enough; one trace disappears while the other one is being swept. When using slow sweep speeds, the chopped sweep gives a much better illusion of having two simultaneous traces. Chopped sweeping, however, has the limitation that the chopping frequency (the speed at which the beam jumps back and forth between the traces) must be much higher than the horizontal sweep speed itself, or you'll see the chopping as a series of square waves, which, of course, is what it really is. So, you use an alternate sweep at high sweep speeds. Most dual-trace scopes let you select either method, but some do it automatically, depending on the sweep speed you choose.

There's one more way to see two channels at the same time: mixed together! Remember our discussion of the distorted audio amp? Well, what if we take the input and output, connect them to our channels and then mix the channels together? If we use the vertical amplitude controls to make them the same size, they'll exactly double, right? That doesn't do us much good, but what if we invert one of the channels? If you'll recall from last month, most scopes have a switch which lets you do that on at least one channel. Now, the signals should exactly cancel each other out, leaving a straight line! If they do, you know there's no distortion in the amplifier. If not, you can actually see the distortion products without the original signal, because you've canceled out what *should* be there! Pretty neat, huh? In practice, you do it

by playing with the output channel's variable amplitude control until the line is as flat as it can be. Whatever's left is the difference between the two signals, not counting their gross amplitude difference. Real circuits always show some difference signal, but you can get a pretty good idea from its size and shape whether it's reasonable or not.

### It's About Time

I think we've covered just about everything vertical there is on an oscilloscope. Now we get to the fun part: time. At first musing, it would seem to be pretty simple. You select your sweep speed and you're done, right? Well, you can do that and, often, it's all that's needed. But, there's lots more and it's all pretty handy stuff.

### Pull the Trigger

Before we get to all the neat things you can do, we need to consider one interaction between the horizontal and vertical domains. In order for you to see a waveform, it must have one important characteristic: It must repeat. Why? Because otherwise it would flash by and be gone before you'd even notice it. To be visible, the beam must trace over the same places on the CRT over and over. Unless you have some method of storage, such as digital memory (which we'll get to later), waveform repetition is an absolute must. (And, if you're looking at two signals at once, they must be harmonically related or one of them will be just a blur.) In the case of a sine wave, square wave, or other simple wave, the point of repetition is obvious: once per cycle. But what about a TV signal or a digital pulse train? Such a complex signal may have all kinds of "cycles" within it and more than one point which could be considered the start of repetition. TV is a good example because it has vertical sync, horizontal sync, color sync, equalizing pulses and more, all organized into a big, long train which truly repeats only every other field. Finding the spot you want takes a good understanding of the entire signal. What's worse, depending on what you pick for your starting point, what you'll see can vary tremendously!

It should be clear that, even for the simplest waveforms, it is necessary to start the scope's trace at the same point on the waveform for each sweep. So how do you pick any spot to begin with? You use the scope's trigger controls. These consist of a variable knob and a few buttons. The knob varies the voltage point at which the trigger "grabs" the signal and starts the sweep. Generally, it's an uncalibrated control; you just turn it until the blur on the screen freezes. Usually, you can pull it out and reverse its slope, which refers to whether it grabs the waveform as it rises in voltage or falls. Doing that lets you start with a different part of the waveform, which may be just what you need in a given situation.

The buttons let you select how the signal is coupled to the trigger circuitry. They function in much the same way as the coupling buttons on the vertical channels. With DC coupling, you trigger on an absolute voltage level. Often, that's fine. But, if you want to

trigger, say, on a particular variation in a 100 mv signal that happens to be riding on 12 volts DC, you would be better off using AC coupling and blocking the 12 volts altogether. Some scopes offer low-pass and high-pass filters on the AC coupling. They are very nice because they let you avoid triggering on noise (with the low-pass filter) or trigger on a high-frequency component of the signal while ignoring its slower changes (with the high-pass filter). Ultimately, you use whatever gives you the view you need.

Some signals are so complex that it is impossible to trigger on them at all. No matter what you do, the trace keeps jumping around, making measurements impossible. Digital pulse trains are notorious for it. Some scopes have a *hold off* control which sets a variable time after triggering during which the scope will not trigger again, even if the trace is finished. This blocks some erroneous trigger points, but it often doesn't work very well if there are lots of them within the signal. The solution is to use a separate connection to some other part of the circuit which has a reliable signal for triggering. Most scopes make it possible by providing an external trigger jack and switch. Naturally, the signal you pick to provide your trigger must be synchronous with the one you want to view or you'll just get a mess on the screen. Luckily, many devices deliberately or incidentally provide such signals. In fact, the alignment instructions for many kinds of gear tell you where to find them.

### Faster—No, Slower

Once you've got your waveform frozen on the screen, you can decide what to do with it. Here's where the sweep speed control comes into play. Calibrated in TIME/DIV, this control simply sets how long it takes for the beam to sweep across the screen. Set it faster and the waveform stretches out. Set it slower and it all squeezes together. Like the vertical amplitude control, it has a variable knob which must be set to its calibrated position for the marked times to be correct.

The calibration refers to the divisions, or boxes, on the graticule. If you set the knob to 2 ms per division, it will take 2 milliseconds for each box to be swept. Knowing that speed lets you do rough frequency measurements; just divide 1 by the sweep speed. Let's try it: You're looking at a sine wave which repeats every 2.5 boxes. (It really doesn't matter which point on the wave you pick as your starting point, as long as you pick the same one for the next cycle.) Your sweep speed is 2 ms/div. To find the frequency in Hz, just multiply 2 ms times 2.5, which gives you 5 ms (the time period of your waveform). Now, divide 1 over 5 ms, and you get 200 Hz. Of course, this method doesn't have the precision or accuracy of a frequency counter, but it does allow you to figure out the frequencies of intricate signals, including those buried within other signals, which is something no frequency counter can do.

Well, we're getting near the end of our oscilloscope tour, but there's still a bit more and I've run out of space, so we'll have to finish up next time. Until then, 73 de KB1UM.

# HAM HELP

Number 24 on your Feedback card

We are happy to provide Ham Help listings free on a space available basis. To make our job easier and to ensure that your listing is correct, please type or print your request clearly, double spaced, on a full 8 1/2" x 11" sheet of paper. You may also upload a listing as E-mail to Sysop, to the 73 BBS/Special Events Message Area #11. (2400 baud, 8 data bits, no parity, 1 stop bit. (603) 924-9343). Use upper- and lower-case letters where appropriate. Also, print numbers carefully—a 1, for example, can be misread as the letters I or i, or even the number 7. Specifically mention that your message is for the Ham Help Column. Please remember to acknowledge responses to your requests. Thank you for your cooperation.

My antennas (VHF and HF) are installed at the top of a building, and to feed them I need 37 meters of coax cable. Presently there are two cables of thin coax. I am losing almost half of my power. I want to feed both antennas with only one coax RG8 and have a relay near the top to connect the antenna in use; or, match both antennas with coax cable. I need information on how to do this. Thank you for your help. Dawid Wahrsager PY1MV, Rua Santa Clara, 431 - Bloco 2 - Apt. 402, Copacabana, 22041-010 - Rio de Janeiro, R.J.

Wanted: Sony CRF 320/330; Panasonic RF 9000; Philips D 2999; Zenith Transoceanic, and the relative literature for each. Please advise regarding conditions and prices, including air mail costs. Send to Sabino FINA, via Cesinali 80, 83042 ATRIPALDA, Avellino Italy.

Wanted: Service information or source for same, for automobile digital instrument clusters. Bill Molenhauer N2FZ, 136 Cedar Ave., Pitman NJ 08071.

Unemployed, newly licensed, Caribbean Ham seeking goodwill donation of ham equipment and related items. If it works I'll take it. No items too big or too small. I will make minor repairs. Age and external appearance not a factor. Jerry Aberdeen J39DF, Westerhall, St. David's, Grenada.

Needed: A pictorial guide and schematic for a Heath Kit Model HX-1681. I will pay for the copy and postage. George Therien KB1AHX, 20 Metcalf Ave., Centerdale RI 02911. Tel. (401) 354-6514.

Wanted: Manual or schematic for the Maverick Dual Power HF Amplifier. If you can help locate these items, please call Jim Hassen KB3ANX, (301) 422-1209.

Attention Hams: If you are using the Apple IIGS Computer for Packet, please write to me. Thank you. William J. Kerr, Sr. KA2KAN, RD3 Box 371, Everett PA 15537.

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## Notes from FN42

This is another busy month with lots of great information. I'm sure that you would rather read about what is happening around the world rather than have me ask you to get involved. Instead, I will let our hambassadors tell you how they and others got involved.

We are lucky to have another ham step forward to let us know what is happening in his country. David Plett 3A2LZ has volunteered to keep us up-to-date on the happenings in the Principality of Monaco. I'm sure that you will enjoy his first of many submissions. 73—Amie N1BAC.

## Roundup

**Australia** Downloaded from packet, WS1O @ W1EHD: IARU Region 3 Chairman David Rankin 9V1RH reports that Ron Henderson VK1RH, President of the Wireless Institute of Australia (WIA), has become a Silent Key. Ron died of cancer on April 26. He was an active operator and a good leader in administrative matters. His passing is mourned by amateurs worldwide, with condolences to his family, the WIA, and his many friends around the world.

**Bangladesh** From the Bangladesh Amateur Radio League (BARL) Bulletin: Finally, amateur radio activities from Bangladesh! S21A, Saif Shahid, the first licensed amateur radio station from Bangladesh, has now been on the air for more than six months and during that time he has made more than 5,000 contacts all over the world. Saif is active on 10, 15, 20, and 40 meters on voice and digital modes, including RTTY, AMTOR, and packet. Saif is also the president of BARL.

S21B, Nizam, is also regularly heard on 20 meters. He works mainly between 1300 and 1600 UTC on SSB and has made over 1,000 QSOs.

The BARL regular monthly meetings, the first Wednesday of the month, are becoming more and more popular. These monthly open forums are open to anyone who is interested in amateur radio and electronics.

Further information about BARL can be requested from BARL, GPO Box 3512, Dhaka, Bangladesh.

**Kazakhstan** Downloaded from packet, WB2DHY @ KC2FD: Beginning March 1, 1993, new call-sigs are being issued. They have

begun assigning a "UN" series of calls in several oblasts. This will continue throughout this year and all the "UL" series will be replaced. UL7 = UN7, RL7 = UN9, & UL8 = UN8. Kazakhstan is getting UN, UQ, and UP callsigns. UL calls will go to Uzbekistan.

Please make note of this information as more confusion will inevitably follow. I anticipate some serious frustration. 73 de Ed NT2X.

**Sweden** From the Sveriges Sändareamatörer (SSA) Awards Program: The SSA sponsors four different awards: Worked All Sweden Award (WASA), Heard All Sweden Award (HASA), Swedish Locator Award (SLA), and the Field Award. Both the WASA and HASA have classes and groups for HF, 144 MHz, 432 MHz, 1296 MHz, and satellite. The SLA will be issued to licensed radio amateurs for verified contacts made with the various Maidenhead locator squares in Sweden. All radio bands may be used and endorsements can be obtained for individual bands and modes. The Field Award will be issued to licensed radio amateurs for verified contacts with fields, as defined by the Maidenhead locator system. Endorsements will not be issued.

For further information contact: Sveriges Sändareamatörer, Östermarksgränd 43, S-123 42 Farsta, Sweden.

**Ukraine** Downloaded from packet, UB5LCV @ N8GTC #CIN. IN. USA: The first Ukrainian International Hamfest, under the motto "Who Is US5?" will be held 21-22 August in Kharkov. The hamfest will include a Ukrainian Amateur Radio League (UARL) presentation, DXpedition reports, awards, contest information, a slide show, VCR tapes, and great cultural programs. Open forums will give everyone an opportunity to find out who we are.

Further information can be obtained from: Igor L. Zeldin UB5LCV, PO Box 4808, 310103 Kharkow, Ukraine; or, for those with packet: UB5LCV @ UB5LMJ. KHA.UK.RU.

## HONG KONG

Phil Weaver VS6CT  
Flat 39C Two Park Towers  
1 Kings Road  
Hong Kong

Spring has arrived in Hong Kong after one of the coolest periods I can remember in 19 years here. It has also been one of the most disappointing periods of propagation that we have had since I first started operating amateur radio here in

1979. Periods of activity have been severely limited this winter by few openings and there hasn't been a lot of rare DX since last year's bonanza, when it seemed like we had new countries coming along every week, giving us more and more of that elusive Honor Roll status. I am one of the lucky ones! Having worked D, ET, FO, HKØ, SØ1, VP8, XE4, YA, ZA, 7ICENI/O, and 1SØ in the last 15 months, I have finally achieved Honor Roll status after 13 years of operating.

Fernando Nacedo Pinto, known when active a few years ago as CR9AK, is in the process of "folding his tent" in Macau to return to Portugal and retire, finally. He had planned to leave in December, and we managed to see him at the ELARCS Annual Dinner. A few days later a farewell party was held at the Yacht Club for his many friends from the many interests in which he participated, from motor racing to yachting to amateur radio. He is a fine example of someone who gave a lot to the hobby. Any ham was welcome in his home in Macau, and I remember doing two expeditions from "Fern's" house in the early '80s.

After nearly three years of negotiation and cooperation between the Telecommunications Authority and the amateur clubs in Hong Kong, we have just been advised that the New Amateur Radio License will be issued in the very near future, having been approved by the Executive Council last December. Considerable improvements, from the point of view of amateurs, have been introduced and many of the previous restrictions imposed have been relaxed. This is not the place to enumerate them all. Suffice it to say, I think we should be grateful to all the people who got themselves involved in this exercise and say "thank you one and all." A new credit-card-size operator's license will also be issued this year. This should overcome the difficulty of being stopped by the police when operating a handie-talkie on the street or if you have amateur radio in the car.

For those of you who are interested in visiting amateur radio festivals or expeditions (by whatever name) but cannot make it to the world's biggest, Dayton in Ohio, USA, I would like to draw your attention to the second biggest, which takes place each year in Tokyo Harumi district during the last weekend in August. I attended this festival once, in 1988, and thoroughly enjoyed it. We hope this year to have a group of Hong Kong amateurs to attend and if we can get a sizable group together, I am sure that we can get some interest in our visit from the JARL, who could probably lay on a party or two. If you want any further information about it, please give me a call at 887-6366.

## ISRAEL

Ron Gang 4X1MK  
Kibbutz Urim  
D. Negev 85530  
Israel

[The following are a few small tidbits from Ron. More will be published next month.—Arnie] For the first time, the "Open University" has instituted a correspondence course for the advanced amateur license—the Class "A."

Packet radio continues to grow in popularity. 4X1MJ in Beer Sheva has made available kits for building the Baycomm modem, which can be put together for a very low cost. With the freeware program, the PC-clone computer takes over the functions of a TNC so that the TNC, an often hard-to-find and expensive commodity, is not needed. In the Beer Sheva area, thanks to Danny's efforts, quite a few new, young hams have been seen on the packet 4XNet.

Congratulations are due to Shlomo 4X6LM, who has completed his first year of editing HAGAL, the IARC magazine. He instituted many changes in the magazine, making it bimonthly and chock-full of technical articles, ham news, and more. The printing and graphics, coupled with the contents, have put the magazine in the first line of the ham publications in the world.

The Holyland Certificate Grid-Square collecting has become a serious mania! Those desirous of the squares should check the following frequencies: 14.265 daily at 1300 UTC, as well as 21.320 and 28.565. Many mobiles are active, putting the rarer squares on the air, and interest is running high. Saturdays on 7.050 MHz, there's great activity with the locals getting in on the fun. For further info on the award, check the back issues of this newsletter.

## MONACO

Daniel Plett 3A2LZ  
B.P. 349  
MC 98007  
Monaco

3A . . . JN33RR . . . 44 degrees 44 minutes North, 7 degrees 25 minutes East . . . Monte Carlo . . . These are all representative of the Principality of Monaco. Famous for its casinos and images of royalty and richness, Monaco is also well-known by amateur radio operators as one of the smallest and most rare countries to contact. Monaco is indeed quite small, one square mile to be exact. However, within this small area, there are about 50 licensed amateur radio operators.

The Association des Radio-Amateurs de Monaco (ARM) is the national society and has 29 members. The society's meeting place is open each Saturday for members to pick up or send QSLs through the bureau, check out recent magazines

*Continued on page 82*

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**05N**

## 73 INTERNATIONAL

Continued from page 80

from other countries, or just catch up on the latest news.

Here are a few bits of information to help you learn more about some of the distinctions of amateur radio in Monaco. All 3A1 callsigns are VHF only, no-code licenses. 3A2 callsigns are for stations with full operating privileges. Probably the two major differences in Monaco are that there are no 6 meter privileges at all, and that the legal limit for all stations is 100 watts. Due to space restrictions, most stations have limited antennas too.

Comments and inquiries are welcome. We look forward to chatting with you on the air.

### OKINAWA

David Cowhig 7J6CBQ/WA1LBP  
AmCon Naha  
FBU PSC 556, Box 840  
FPO AP 96372-0840

The coming of New Year 1993 brought New Year's greetings lasting throughout the month of January on the Japanese ham bands. Akemashite omedeto gozaimasu! If you plan to visit Japan, be sure to write the International Section, JARL, Sugamo 1-14-2, Toshima-

ku, Tokyo 170 Japan, about two months before you go for an application form. Once JARL receives your application, they will translate it into Japanese and send it on to the Japanese telecommunications authorities. Your license will be ready in about two weeks. The JARL does a great job helping foreign hams who come to Japan. The Japanese use the 144-146 MHz band largely for FM simplex and packet (in kanji characters and Kana as well as alphanumeric characters) while repeaters (all-tone access—here in Okinawa mostly 88.5 Hz) are found on the 430-440 MHz band. You may need to modify your "made for the US market" handie-talkies to transmit in this range by cutting the right wire (and not the wrong wire, like I did).

In Okinawa, where Japan's spring begins, spring is starting its long northward trek towards snow-bound Hokkaido. Nago in northern Okinawa is now celebrating its annual Cherry Blossom Festival. Five Japanese professional baseball teams as well as two others from Korea and Taiwan began spring training in early February.

During our two-week-long Chinese New Year's visit to my wife's family at Bamboo Mountain (Chushan) in central Taiwan, I visit-

ed ham operator Jan Yigong BV5BR in his ham radio store in nearby Douliu. Mr. Jan's five-bay 2 meter antenna makes his downtown ham store hard to miss. Mr. Jan told me that the lower age limit for hams is 18, that the ham exam is given only once a year, and that since there is only one class of ham license, passing the exam (which includes an English language test!) is difficult. I told Mr. Jan about the US multiple-grade ham radio licensing system in the USA and about the Springfield Estates Amateur Radio Club started by Keith and Luke KO4IQ Ward in Springfield, Virginia, to show how young people can play a big role in ham radio [See the ARRL Education Workshop Proceedings 1991 for the story of this club]. Mr. Jan would like to see these things for Taiwan, too, but revising the Taiwan ham regulations will have to wait until the Taiwan radio world settles down.

Taiwan hams have had permission to set up repeaters since January 1, 1993. Although Taiwan hams have the 2 meter assignment of 144-146 MHz, they cannot use the lower 500 kHz of the band until the police move off it, perhaps sometime during 1993. There are college ham clubs in Taiwan at

Chenggong University and at Tsinghua University in Hsinchu. Mr. Jan explained to me that in Taiwan, hams (numbering about 2,000) are called huotui (hams), while their unlicensed brethren, the 300,000 or so xiangchangzu (sausage tribe), wander at will through various frequencies (they like 141 MHz best), in and out of the ham bands. Ham radio equipment is freely available and affordable in Taiwan so hams end up being much in the minority on the VHF and UHF ham bands. The HF ham bands are, in practice as well as theory, mostly reserved for hams. Fishing boats from Taiwan and southern Asia are often heard on 27-29 MHz.

The Taiwanese have been allowed to use radio transmitters only since martial law ended three years ago. Before then the only radio rule was that you were absolutely not allowed to transmit or possess a radio transmitter. The opening up of radio makes necessary a complex set of regulations which are not yet in place, although the Legislative Yuan of the ROC Taiwan government will probably make some progress on this during 1993. Taiwan hams regularly contact and visit in person their ham friends in the Chinese mainland.



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#### JULY 24

**GOWANDA, NY** The 4th annual Swap 'N Shop, presented by the Tri-County ARS, will be held at Gowanda Firemen's Grounds, Sand Hill (Rt. 62), beginning at 7 AM. Talk-in on 146.745 rpt. Contact Andy K2ISN, (716) 532-2250; or Tom KD2EG, (716) 532-5743.

**LANCASTER, PA** A Computer & Electronics Show will be sponsored by the Red Rose Repeater Assn., from 9 AM-3 PM, at McCaskey High School. Talk-in on 147.015/615. Contact Wade Mackey, 5 Sunrise Terrace, Millersville PA 17551. Tel. (717) 872-5328.

#### JULY 24-25

**MANCHESTER, NH** The New England Div. Convention will be sponsored by the New Hampshire ARA, and will be held at The Center of New Hampshire Conference Center, from 8 AM-4:30 PM. Walk-in VE Exams. Talk-in on 146.85- (wide area), 147.255+ and 223.9 (local). Contact New Hampshire ARA, P.O. Box 573, Derry NH 03038.

**WOODLAND PARK, CO** The Mountain ARC will hold its 12th annual Swapfest/Campout in the Colorado Rockies at Red Rocks Campground in the Pike Nat'l Forest (4 miles north of the city center on Hwy. 67). Campers: Advance reservations are a must. Talk-in on 146.82 rpt. Get details from Bob, (719) 687-9025; or Fred or Patty, (719) 687-9727. For reservations or info sheet, write MARC, Box 1012, Woodland Park CO 80863-1012.

#### JULY 25

**BALTIMORE, MD** The Baltimore Radio Amateur Television Soc. (BRATS) will hold its annual Maryland Hamfest and Computer Fest at the Timonium Fairgrounds. VE Exams will be given at 10 AM only. Pre-registration is required. Call Les McClure W3GXT, (410) 833-8667 to pre-register. Talk-in on 147.03 and 224.96 MHz rptrs. For info call (410) 467-4634, or write: BRATS Hamfest, P.O. Box 5915, Baltimore MD 21208.

#### JULY 30-31

**MANISTIQUE, MI** The '93 U.P. Hamfest will be held at the Schoolcraft County Fair Building, Sat., July 31st, 8 AM-5 PM. There will be a Fish Fry Fri. night. Contact Debra K. Barton WB8IBT, eves., (906) 341-5694; or write M.A.R.A., P.O. Box 144, Manistique MI 49854.

#### JULY 30-AUG 1

**REGINA, SASKATCHEWAN, CANADA** Luther College at the University of Regina Campus will be the stage for "Regina Hamfest '93," sponsored by the Regina ARA. Address inquiries to: Lyle Hopwood VE5HL, @VE5AGA.SK.CAN. NOAM, 4530 3rd Ave., Regina Saskatchewan S4S 0E8, Canada.

#### AUG 1

**SUGAR GROVE, IL** The Fox River Radio League will hold a Hamfest at Waubonsie Community College starting at 8 AM. VE Exams at 10 AM. Talk-in on 144.87/145.47. Contact Bill Schaben

WA9AUW, (708) 208-4870; or Don Rasmussen N9III, (800) 472-7826.

**CROOKED LAKE, IN** The annual Land of Lakes Angola Hamfest will be held at Steuben County 4-H Park, from 6 AM-1 PM. Talk-in on 147.180; packet 145.090; 444.350-131.8 tone; 224.94, 53.050. Contact Land Of Lakes Angola Hamfest, Sharon Brown WD9DSP, 905 W. Parkway Dr., Pleasant Lake IN 46779. Tel. (219) 475-5897.

#### SPECIAL EVENT STATIONS

#### JUNE 16-27

**FT LAUDERDALE, FL** N4PZN/MPS will operate from the manual-powered submarine races 1200Z-2400Z. Frequencies: SSB - 14.230, 21.300, 28.500; FM - 146.300 simplex; CW - 7.110. Sponsored by AUTEC ARC, Andros, Bahamas.

#### JULY 4

**THOMPSON, OH** Station KD8FJ will operate (starting at 1400 UTC) from Heritage Hill Camp, in conjunction with the 7th "Heritage of Our Country" celebration. Operation will be in the lower portion of the 40m General phone band, and on 10m phone at 28.453 (if conditions allow). QSL with a large SASE to KD8FJ, 386 Cedarbrook Dr., Painesville OH 44077-2849.

#### JULY 8-11

**WICHITA, KS** The YRL Convention will operate Station KB0FUN, on all bands, 1700Z July 8th thru 1600Z July

11th. QSL cards will be mailed to all stations worked.

#### JULY 9-11

**NORTH DAKOTA, USA - MANITOBA, CANADA** Station VE4IHF/will operate from the U.S. Lodge Internat'l Peace Garden during the Internat'l Hamfest. Frequencies: 3.937, 7.255, 14.255, 21.355, and 28.355. QSL with an SASE and a IRC or a green stamp, to John Swanke KA0SLI, Box 304, Lakota ND 58344.

#### JULY 10

**CAPE VINCENT, NY** The Jefferson County RAC will operate N2JOA 1200Z-2400Z to celebrate the 25th Annual French Festival, commemorating our French heritage in Northern New York State. Operation will be in the lower General CW and SSB portion on 80m, 40m, 20m, and 15m, and the lower Novice CW and SSB portions on 10m. For a certificate, send QSL and SASE to JCRAC, P.O. Box 523, Brownville NY 13615.

**ENDICOTT, NY** Station KB2JZG will operate from 1300Z-1900Z, (in conjunction with a M1 Rifle Clinic) to recognize the US Dept. of the Army, Office of the Dir. of Civilian Marksmanship programs for firearms competence. Operation will be in the lower portions of the General 40m, 20m, and 10m phone subbands. For a certificate, send QSL and SASE to M1 Special Event, P.O. Box 572 Union Station, Endicott NY 13760.

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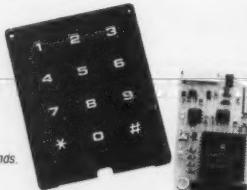
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### JULY 10-11

**FULTON, NY** The Oswego County AR Emergency Service (ARES), will operate KY2F 1200Z-2100Z, each day, from the Central NY Intern'l Air Show at the Oswego County Airport. Operation will be in the middle of the General 80m, 40m, 20m, 15m, and 10m phone bands; the Novice portion of 10m; 147.75/15 MHz; and packet on 144.91 MHz. For a certificate, send your QSL card and a large SASE to *Fred Swiatlowski KY2F, P.O. Box 5227, Oswego NY 13126*.

**U.S./CANADA** Amateurs affiliated with the American Sunbathing Assn, The Naturist Soc., and the Federation of Canadian Naturists, will be celebrating National Nude Weekend by operating a series of Special Event Stations at nudist parks and nude beach sites across the U.S. and Canada. Operation will be from 10 AM-3 PM local time on 40-2m. For a certificate, indicate all sites worked and send QSL(s) with a 9 x 12 SASE to *Naturist Society Amateur Radio SIG, Box 74A Ash Rd., Coatsville PA 19320*.

### JULY 11

**TATAMY, PA** Tatamy PA will celebrate its 100th Anniversary, and will operate KA3OEG from 1400Z-2000Z as a part of the Centennial celebration. Frequencies: 3.965, 7.2675, 14.265, 21.365, 28.365. To get a certificate, send QSL Info and a SASE to *KA3OEG, Box 193, Tatamy PA 18085*.

### JULY 17

**BATH, NY** The Keuka Lake ARA, Inc., will operate AA2CJ, 1300Z-2400Z to commemorate Living History Day, as part of the Town of Bath's 200th Anniversary. Frequencies: CW - 3700, 7125, 28200; phone - 3875, 7240, 14250, 28400. For a certificate, send QSL and a 9 x 12 SASE to *Reginald Gehret N2MAH, 125 E. Washington, Bath NY 14810*.

### JULY 17-18

**STRATFORD, NY** The Fulton County Historical Soc. will operate W2ZZJ 1400Z-2000Z, July 17th and 18th, to celebrate the 167th anniversary of the birth of Dr. Mahlon Loomis, the American wireless telegraphy pioneer, who was born at nearby Oppenheim. For a certificate, send QSL, contact #, and a #10 SASE ONLY to *W2ZZJ, HC Box 80, Stratford NY 13470*.

### JULY 24-25

**PORT HURON, MI** The Eastern Michigan ARC will operate K8EPV 1400Z Jul 24-0200 Jul 25; 1400Z Jul 25; and 1400Z-0200Z Jul 26, to commemorate the 68th Port Huron to Macinac Island Yacht Race. Frequencies: CW - 3.710, 7.110, 21.110; SSB - 3.910, 7.262, 14.262, 21.312, 28.393. For a unique certificate, send QSL and a 9 x 12 SASE to *K8EPV, 1640 Henry St., Port Huron MI 48060*.

**PORT ORCHARD, WA** Kitsap County ARES will operate AA7LP from 1700Z on July 24-0300Z July 25 (0900-2000

July 24 PDT) to celebrate the 20th anniversary of Silverdale Whaling Days. Operations will be on 28.330 MHz (USB) and 147.510 MHz (FM simplex). For a QSL card, send your QSL and an SASE to *Matt Amis AA7LP, 2196 California Ave. E, Port Orchard WA 98366*.

### JULY 26-AUG 1

**CANTON, OH** The Canton ARC will operate Station W8AL (1000 UTC-0200 UTC) to celebrate the Pro Football Hall of Fame Greatest Weekend. Frequencies: SSB - 28.350, 24.950, 21.350, 18.150, 14.270, 7.270, and 3.870 MHz; CW - 28.125, 24.910, 21.125, 18.080, 14.050, 10.120, 7.125, and 3.700 +/- QRM. There will also be RTTY, packet, AMTOR, satellite, and 2-meter FM/SSB. SWLs are welcome. For an unfolded certificate, send your QSL with contact number and a 9 x 12 SASE, with two units of first-class postage. For a QSL or a folded certificate, send your QSL with contact number and a #10 (business size) SASE to *Randy Phelps KDBJN, 1226 Delverne Ave. SW, Canton OH 44710-1306*.

### JULY 30-AUG 1

**WIESBADEN, GERMANY** CQ de Frankenstein!! The Wiesbaden ARC will operate Station DA1WA from 2000 UTC July 30-1200 UTC Aug. 1, on 80-10m in SSB, CW, and digital modes, from the famous castle near Darmstadt, during their 4th annual Castle Frankenstein DX-pedition. QSL via the bureau or direct with two or three ICRs or "Green-

stamps" to *Robert Kipp DJOPU, Hügelstraße 25, D-6070 Langen, Germany*.

### JULY 30-AUG 8

**MIDDLETOWN, OH** The Dial ARC will operate club station W8BLV from the National Hot Air Balloon Championships, evenings and weekends. Frequencies: SSB - 3.965, 7.265, 14.265, 21.365, 28.365 and 2 meters. CW - 10 kHz from the bottom of Novice bands. For a special balloon QSL, send your QSL and a SASE to *Ernest Howard AG8Y, 4003 Lewis Street, Middletown OH 45044*.

### AUG 2-6

**GRAND HAVEN, MI** Members of the North Ottawa ARC will operate K8AR 1200Z-2100Z Aug. 2-8, to commemorate the 203rd Anniversary of the U.S. Coast Guard from Coast Guard City USA. Operation will be in the bottom portion of the General phone subbands. For a certificate, send QSL card and a 9 x 12 SASE to *NOARC, P.O. Box 44, Ferrysburg MI 49049*.

### AUG 12-14

**GLENS FERRY, ID** The Southern Idaho Hams will operate K7QQP to celebrate the Three Island crossing of the Oregon Trail. Operation will be on SSB - 75m, 40m, 20m 15m General portion; 10m Novice/Tech portion, Thurs. 1800Z-Sun. 0600Z, or as long as conditions last. For a 3 x 6 card, send your QSL card and an SASE to *Paul KB7QHH, 5107 Grover, Boise ID 83705*.

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## NEVER SAY DIE

Continued from page 4

### Data Communications

It's one thing to be able to talk and another to find out what to talk about. I'd like to see some sort of system where I could get a dump of subjects of interest to the chap I'm talking with. My computer would highlight anything of mutual interest, giving us an edge in starting a conversation of interest to both of us. We should be able to dump something like that in a couple of seconds. Work on it, okay?

Yes, I know we aren't permitted to mix packet and voice on the same frequencies, so we'll need to get some Special Temporary Authority (STA) permits to develop these multimode communications systems. You shouldn't have any problem getting the permits.

### A New Day Dawning

If we can pull this off I believe this could completely revolutionize the amateur service. We'll be able to really build some international friendships. Special interest nets will start growing around certain frequencies. For the first time we'll be able to actually talk with each other instead of lecturing.

It's going to be a lot easier to get kids interested in hamming. We may even be able to get our growth rate back where it was 30 years ago!

We've got 100,000 ham channels sitting unused just on 10 GHz, so we could use a few more hams.

With our being able to talk in groups sharing channels we'll be able to handle substantially more operators on our HF bands. We may have to insist that the ARRL shelf its confounding DXCC award so operators in rare countries aren't swamped with wallpaper hunters.

I would never say it, but there are those who claim that country hunters are trying to compensate for inferiority complexes. There are thousands of addicted ops who will fight the pile-ups for hours to get a five-second signal report from some damned rock sticking out of the ocean. I'd like to see their explanations to St. Peter about this silly waste of a life.

### How Was Dayton?

Well, I had a good time . . . how about you? Oh, it was crowded. No, it was far beyond being crowded . . . It was packed solid. On Saturday there wasn't any way to get around. The exhibits had people stacked two and three deep, which left almost no room for anyone trying to get through the aisles. I got around as best I could, jumping up near each booth to try and see over the crowd what was being exhibited. I'd hoped to pick up literature, meet the entrepreneurs, and ask a lot of questions, but getting close

enough to talk turned out to be difficult.

Yet many dealers were complaining that sales were way down from last year. I did see a lot of stuff being carried from the flea market to cars, but not much in the way of new gear going that way.

There was an industry meeting on Thursday evening . . . run by CQ magazine. It turned out to be mostly a promotion effort for a series of professional hamfests they're planning. They seem to feel there's big bucks to be made in hamfests. Maybe. I guess the thing that puts me off is that hamfests haven't seemed to change much in the 55 years since I attended my first. Well, maybe they don't need to.

One motivation for the commercializing of hamfests seemed to be the lack of any regular hamfests in Northern and Southern California. With over a hundred thousand hams in that area, obviously (they opined) it should be able to support two yearly hamfests. Having attended quite a few California hamfests, I'm skeptical. In case you haven't been out there, California hams are different. They have shown that they are able to stay away from hamfests in huge numbers. Perhaps whatever weird psychological forces drove these strange people to move to California doesn't encourage them to seek the comfort of crowds. They seem to be a bunch of individuals, with little of the lemming-drive of Eastern-

ers to pile up into large human masses such as we see at Dayton, Boxborough, Atlanta and other such hamfests.

Armed with what seemed to be an instant statistic that 41% of all ham gear is bought at hamfests, the CQ team is going to try and organize the hamfest business. What's the "Q" code for "good luck"?

### I Lusted.

I saw an awful lot of new equipment that got my juices going. Great stuff. Wait'll you get a load of the stuff AEA has for you. They've got a great SWR gadget that plots the SWR vs. frequency for you. At \$400 it's a bit pricey for most hams, but what a great gadget for clubs to buy and share. Once you see it, if you ever want to have your antennas working at their best, you're going to have to get one of these killers.

And of course their new packet contraption does so much that they should have a 10-hour video training course just to get you familiar with what they've crammed into that little box.

There were some fabulous new linear amplifiers that would look great in my shack. And maybe it's time to decide which new rig to get, and what kind of an antenna will give me a monster signal on 20m.

Continued on page 88

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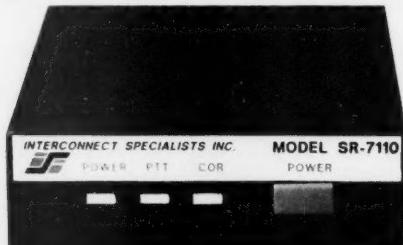
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The 73 Flea Market, Barter 'n' Buy, costs you peanuts (almost)—comes to 35 cents a word for individual (noncommercial) ads and \$1.00 a word for commercial ads. Don't plan on telling a long story. Use abbreviations, cramp it in. Be honest. There are plenty of hams who love to fix things, so if it doesn't work, say so.

Make your list, count the words, including your call, address and phone number. Include a check or your credit card number and expiration. If you're placing a commercial ad, include an additional phone number, separate from your ad.

This is a monthly magazine, not a daily newspaper, so figure a couple months before the action starts; then be prepared. If you get too many calls, you priced it low. If you don't get many calls, too high.

So get busy. Blow the dust off, check everything out, make sure it still works right and maybe you can help make a ham sure it still works right and maybe you can help make a ham newcomer or retired old timer happy with that rig you're not using now. Or you might get busy on your computer and put together a list of small gear/parts to send to those interested?

Send your ads and payment to the Barter 'n' Buy, Judy Walker, 70 Rt. 202N, Peterborough NH 03458 and get set for the phone calls.

**The deadline for the August classified ad section is June 10, 1993.**

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Continued on page 89

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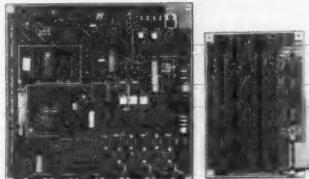
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# NEVER SAY DIE

Continued from page 86

## And I Talked, Too.

For two hours! And it was only Sherry pulling my sleeve, reminding me that we might miss our plane . . . and the increased signs of frustration of the AMSAT bunch, who had the next stint in the room, that stopped me. What did I talk about? Oh, all this stuff I've been writing in my editorials, in my *Declare War* book, and *Declare War Updates*. I talked about my sneaky plan to get everyone off simplex and into duplex operation . . . a move which we should have made 50 years ago.

I talked about EMFs and cancer. I talked about how our cells communicate. And ecoscams; the plight of IBM and what could be done to save the collapsing giant . . . if anyone thinks Big Blue is worth saving. I talked about our basis and purpose (97.1) being totally obsolete, the stupid proposed VAT, defunding NASA and the superconducting supercollider, how America can make money on foreign loans instead of just throwing it away, and so on.

Oh yes, I also mentioned a huge coincidence that I've recently discovered. You're probably going to disagree with my take on this, but I'll tell you anyway. I've noticed that there seem to be almost no well-educated poor people . . . and almost no poorly-educated rich people. Now, it struck me that this may not be entirely an accident. Could there be a correlation between education and success? And if there is, do you think this might be enough to convince kids that education really is important if they're interested in not being poor all their lives?

Of course they may prefer to play the odds that they'll become successful performers, athletes, politicians, or clergy, where an education isn't critical. At least for a while. Then, how many rich boxers are there? How many rich ballyplayers? Dozens. And how many rich business people? Millions. But is that enough to get people to think?

The cold, wet, windy weather drove the flea market scavengers inside, making it even more difficult to move around. It finally got to where it was no longer possible to talk with exhibitors . . . I couldn't get near 'em' so Sherry and I headed back to crowd-free New Hampshire.

I did enjoy meeting a bunch of old friends. Not having a booth this time gave me a lot more freedom to get around. I wore a 73 hat so people could spot me, but I found that no one looked at hats. Too bad, because I had it all decorated with badges and buttons . . . my submarine combat pin from WWII, my Royal Jordanian Radio Society (JY8AA) pin, my Korean Amateur Radio League (HL9WG) pin, one from New Zealand, one from China, Russia, and one from Poland. My hat was decked out like a CBer's vest at a CB picnic. No one noticed. Heck,

I even had a little gold hand key, my Old Old Timer's Club pin, and my old Boy Scout pin from the '30s. I used to have some pins for winning ARRL contests, but some ex-employee mercifully swiped 'em. Yes, of course I had my ARRL 50-year pin on there, right up front. And one from Erasmus Hall High School. Well, what on earth else could I do with all that memorabilia? Waste of time. It was invisible. Phooey.

The post office has been putting out some postage stamp pins, so I put on the 5¢ ham stamp, ugly as it is . . . and a Scott Joplin stamp pin, promoting the five Greener Pastures Joplin CDs I've put out so far. I put on a skin diving pin, but couldn't find any of my skiing pins. Just as well.

So I'll put the hat, with all the pins on it, up in the attic, and go bareheaded at future hamfests. You had your chance to admire my collection and you muffed it . . . all 30,000 or so of you.

## Ham of the Year!

I was delighted to see that the Hamvention Ham of the Year award went to Harry Dannels W2HD. Harry and I go way back.

The main reason for giving him this prestigious award was Harry's getting the QCWA to support the no-code proposal . . . a change of heart on his part which amazed me at the time. That's what I would have expected of Harry Gartsman W6ATC, the previous president, for whom I have a ton of respect, but Dannels has been so steadfastly pro-CW all of his life that I was certainly surprised.

I first ran into Harry when he ran for ARRL Hudson Division Director in the '50s. I think this was when he became a big Wayne Green fan. He's been talking about me at hamfests and over the air to anyone who will listen ever since. I understand that now that he's retired all he does is sit and talk on a Virginia repeater day and night, mostly about me. I count him as one of my number one fans.

Harry's big aim in life was to be an ARRL director. I think his father had been one and he wanted to prove to his father that he could do it too. I remember his father, a true CW fanatic. I remember him diligently jamming DX phone ops on the low end of 80m with endless CQs. This is still one of the more popular aspects of our hobby.

When I worked with Chet K2EAF on the 1960 ARRL National Convention in New York City, Harry was the president of the Hudson Amateur Radio Council, which sponsored the show. Harry came across to many people as a small-minded, fatuous, ARRL apparatus chick. I was there when he was elected to that position by the newly formed Council. He managed this coup by outtalking everyone else, even though he didn't really have anything to say. No, I was not jealous. I was busy starting 73 at the time, so running HARC was not an option for me. Plus, I was the president of the Porsche Club of America. I was just

amused that the deciding factor in who was elected turned on who talked the most, and never mind what they had to say. I filed that away in my mind just in case something like that ever came up where I wanted to be a club president.

After Mort Kahn W2KR retired as Hudson Division director, Harry grabbed that job. It was Mort, a retired millionaire, who was the brains (a term which obviously I am using loosely) behind the ARRL's "Incentive Licensing" fiasco . . . by far the worst disaster in the history of the hobby. Harry, a devoted company man, rose to the presidency of the League. I attended several of his talks at conventions and found no reason to change my early opinion of him.

I always admired the League's ability to overlook their rules against directors working in the communications industry when it came to Harry, who worked in the communications department of an aviation company. I got the feeling that they invoked that rule only when someone was running for director who had not come up through the League traffic-handling system.

I saw no signs that Harry had shown any signs of initiative while ARRL president, so his turn-around with the QCWA was an eye-opener. The new Harry was a winner, so I'm delighted that he's been honored by the Hamvention. I've known most of their award winners . . . such as Bill Pasternak WA6ITF, who wrote for 73 for years. Heck, he helped me move the magazine from Brooklyn to New Hampshire back in 1962. Another winner was Carole Perry WB2MGP, who writes our Novice column, and has had a profound impact on our hobby.

We ought to have more awards for outstanding hams. Naturally my twisted mind suggests that we should have both good and bad awards. We ought to have some way to honor Herb KV4FZ for his yeoman work in erecting an outhouse over 14.313 and giving amateur radio its biggest-ever black eye. And a posthumous award to W2BIB for his great work in jamming medical emergency nets. And let's not forget K1MAN, the man who rains on our parade with endless self-promoting blind broadcasts.

The good guys, like John Williams W2BFD, who pioneered RTTY; and Sam Harris W1FZJ, who showed us what could be done with moonbounce and invented the parametric amplifier, got passed by. How about Bill Hoisington K1CLL, who got a whole generation building UHF equipment?

Now that Harry has turned against CW, will we see the QCWA promoting no-code Extra Class licenses? That'll increase Harry's esteem even more in my tired old eyes. And if you're ever near Virginia please look for Harry and find out why he's such a devoted fan of mine. He's on the repeater day and night, so you can't miss him. But I do wish he'd take off at least a hundred pounds so he'll live longer and

thus be able to spread the good old Wayne Green word longer.

## Reflecting The Recession?

Despite the crowds, many exhibitors I talked with felt that attendance was down this year. And I was surprised to find some areas where there had been exhibitors in the past, but were now sitting empty and unused. Apparently the recession has hit amateur radio. Well, it isn't going to be anything like the disaster of 1964, when amateur radio sales dropped 85% in one year.

As I explained a few months ago, it wasn't the recession that caused 73 to not have a booth this year. We looked at the sales figures over the last few years and found that most of the Dayton bunch were already subscribers. We weren't picking up enough new subscribers to pay for the booth, shipping the exhibit, plus a couple people to handle it. And I found that having a booth kept me from seeing as much of the show as I wanted . . . crowds permitting.

I'll be interested to hear from any exhibitors on how the show went. Was it profitable? If you're not sure how you can tell, use the same yardstick as you would for any other promotion...did you sell at least 10 times the total cost of the show in merchandise? And that's if you're making at least a 10% net profit with your product. If you're making 20% net, then you can get away with only five times the cost of the convention in sales to break even.

If sales are really down, this may turn out to be a poor time for CQ to launch a series of commercial hamfests.

## Review: Universal Time Piece

What kind of a crummy hamshack doesn't have a large clock on the wall? Pathetic! No wonder I get so many QSL cards with the wrong time on 'em. Nitwits. Lids. You want a nice big clock that'll keep accurate. Further, since this is your hamshack you don't just want any lousy big clock up there. Your want to cream your visitors with a high-tech scientific clock . . . one that will have them asking questions you can smugly answer, but which they won't understand. It's the only way to run a hamshack. You are an electronic genius and they are morons, and remember that. But please be kindly in your condescension.

The epitome of clock one-upmanship is the Spectra-Com WWV-format Universal Time Piece, available from JZO Research. This 10-inch colorful beast deciphers the scratches, buzzes, beeps, tones, clicks, and announcements from WWV. It tells you when to listen to get solar storm activity reports, which is something no bone-and-fried amateur can be without for more than a day. (Regular price, \$49.95; limited introductory offer, \$29.95; plus \$4.50 S&H. JZO Research, 7140 Colorado Avenue North Minneapolis MN 55429.)

**WANTED: TEN GOOD HAMS.** K7JBQ is looking for a few good hams to join him in his growing consumer electronics business. Seeking quality, not quantity. Put your electronics knowledge to work for you. Write: BILL, K7JBQ, 916 SE 5th Ave., Delray Beach FL 33483. Include callsign and home phone number.

BNB315

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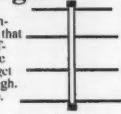
Continued on page 91

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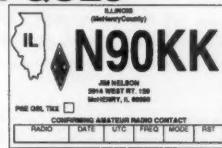
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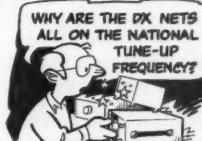
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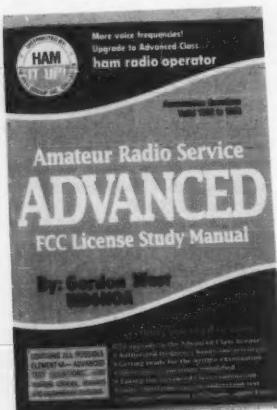
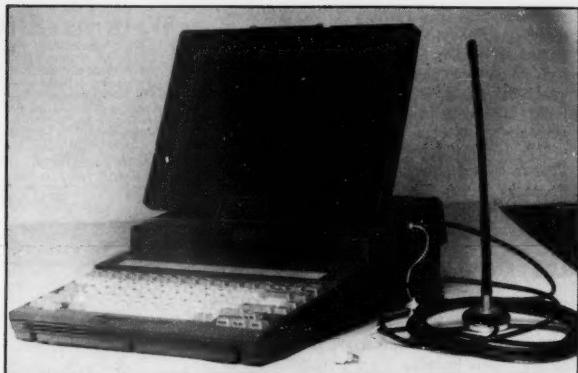
Continued from page 75

### PKT ELECTRONICS

PKT Electronics' PC Packet Station™ is a complete 2 meter packet amateur radio station on card for IBM compatible computers—simply plug in the PC, add an antenna and you're on the air. The PC Packet Station contains a quality Motorola 5 watt transceiver and a modem. It fits a standard IBM PC half-card slot and is compatible with both XT and AT computers. No external power is required. This is an ideal amateur station for computer users with the new no-code Technician Class license. There is no

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The PC Packet Station is priced at \$419 for a single channel and \$459 for a dual-channel unit. For more information, contact PKT Electronics, Inc., 2668 Haverstraw Ave., Dayton OH 45414; telephone: (513) 454-0242, Fax: (513) 454-0242. Or circle Reader Service No. 205.



### GORDON WEST

Amateur radio operators wishing to upgrade to Advanced Class may now obtain the 173-page FCC license preparation book written by well-

known instructor Gordon West WB6NOA. The Advanced book covers all 507 examination questions, four possible answers for each question, and West's unique explanations. The first 18 pages are devoted to bringing the licensed radio amateur up to date on recent changes within the Amateur Radio Service. Chapter 3 specifically guides the radio amateur through testing procedures for the Advanced Class exam. Gordon West covers each question including why the right answer is correct and offers tips on how to solve some of the Advanced Class math problems. West gives some formula shortcuts not found in any other publication.

The Advanced Class FCC license preparation book is available through most amateur radio dealers, or mail order from the W5YI Group at (800) 669-9594 for \$9.95. For more information, contact Gordon West's Radio School, 2414 College Drive, Costa Mesa CA 92626; (714) 549-5000. Or circle Reader Service No. 209.

### LIGHTNING INDUSTRIES

MacRadio™ from Lightning Industries is an interactive study program for the new pool of FCC test questions for the Novice and Technician Class licenses. It contains all possible questions and answers that can be asked on a test. The questions and answers can be studied as flash cards or as practice tests. MacRadio's test generating function produces FCC-style examinations at the push of a button. The test can be taken on-screen or printed for use in a class-

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MacRadio is priced at \$29, plus \$3 shipping. California residents add sales tax. For more information, contact Lightning Industries, 1806 Millmont Dr., #125, Milpitas CA 95035; (408) 942-7998, Fax: (408) 262-5441. Or circle Reader Service No. 203.

### CURRY COMMUNICATIONS

Curry Communications is offering two new products. The LF2A is a compact active antenna system for optimum low frequency reception in noisy environments. It features broadband coverage from 4 kHz through 450 kHz and more than 90 dB attenuation at 540 kHz. Low-profile and portable, it mounts easily to any pole or mast.

It virtually eliminates power line noise and hash, 10-element filtering eliminates AM/SW broadcast interference. There is substantial reduction in TV horizontal oscillator interference and light dimmer interference is eliminated.

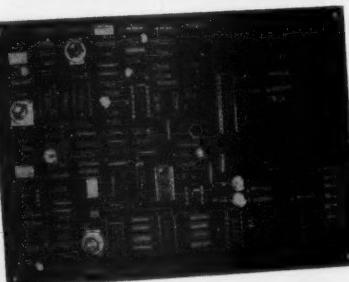
The Model ANB-1089 receiving processor provides any long-wave receiv-

### MILESTONE TECHNOLOGIES

Milestone Technologies has released Milestone LOGMASTER II, an update of the popular ham radio and SWL log-keeping program for DOS computers. The new version represents a complete redesign, incorporating a lot of changes requested by our customers, especially in the areas of the user interface, performance, contest operation and reporting. Milestone LOGMASTER and the CODEMASTER Morse training application have been continuously upgraded since their initial release in 1985, and this upgrade takes advantage of the latest compiler, database and processor technology. User control of the program has been significantly enhanced and there is a completely new user interface which supports (but still

does not require) the use of a mouse. A completely reworked database design allows for the maintenance of multiple logs for special purposes, such as DXCC and contesting, and the number and size of logs is limited only by the available disk storage space. A key feature is ease-of-use: Anyone who can keep a paper log can use LOGMASTER straight out of the box.

LOGMASTER II is priced at \$29.95. Current users of LOGMASTER can upgrade for a nominal handling charge of \$10. For more information, contact Milestone Technologies, 3140 South Peoria St., Unit K-156, Aurora CO 80014-3155; telephone: (303) 752-3382.. Or circle Reader Service No. 204.



ease and flexibility of use as other systems costing 10 times as much. The Roanoak Doppler DF Unit features a 16-LED circular indicator which provides 22.5 degree resolution which is quite adequate for mobile use. The kit comes ready-to-assemble, with over 95% of the entire project on the PC board and it can be assembled in about an hour.

The board and component kit sell for \$87.50 postpaid; Transmitter Hunting is \$19.95 plus \$2.90 shipping. Enclosure kits and antenna array kits will be released soon. California residents add sales tax. For more information, contact Douglas RF Devices, P.O. Box 246925, Sacramento CA 95824-6925; telephone: (916) 688-5647. Or circle Reader Service No. 206.

### DOUGLAS RF DEVICES

Douglas RF Devices has released a PC board and component kit for the Roanoak Doppler DF Unit featured in Transmitter Hunting—Radio Direction Finding Simplified by K6OV and WB6UZZ. This unit offers the same

er with improved flexibility and reception capabilities. The ANB-1089 features: a selectable 20 dB gain preamplifier; a 15 kHz bandwidth filter; automatic noise blanking (threshold adjustable); adjustable IF shift; continuous coverage from 10 kHz to 450 kHz; and a connection for oscilloscope monitoring of noise blanking. It's ruggedly built, small, and portable.

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Continued on page 92

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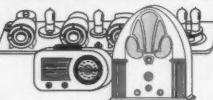
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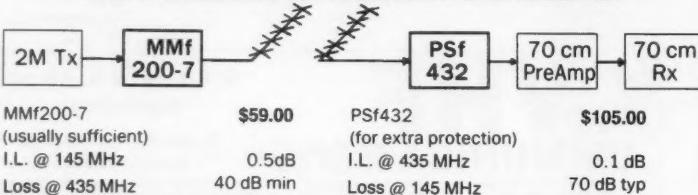
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# RANDOM OUTPUT

Number 30 on your Feedback card

## First QSOs

Almost every ham has an elmer in his or her past. I had several, mostly the faculty advisors and other members of the Brockton (Massachusetts) High School Amateur Radio Club. Somewhere buried in a box are the high school yearbooks that contain the names and pictures of these elmers, but I can't for the life of me remember their names off the top of my head. Maybe I ought to dig out those old books.

I remember my very first QSO under my own callsign. It was with a station in Dallas, Texas, and I don't even have to look in my first logbook to tell you that it was on the 15 meter Novice band. My callsign at that time was WN1UIR, soon to be changed to WA1UIR when the FCC stopped giving Novices the special WN prefix. Since I was operating from a fellow radio club member's home station, I dutifully signed WA1UIR/1, as was required at the time.

Like probably hundreds of thousands of other first QSOs, mine was made on a Heathkit HW-16. For those of you who have never had the pleasure of a QSO on a HW-16, I pity you. To my 14-year-old eyes, it was the embodiment of wonder and adventure. It's dial lighting emitted a soothing glow in the dark, cool basement of my friend's house. The matching VFO allowed us access to the entire Novice HF frequency allocation.

My friend made a few contacts, and I copied along. Finally, he turned the straight key over to me and said, "Go ahead . . . give it a try." I tuned around and found an open spot and committed my first act of RF emission.

"CQ CQ CQ YQ CQ YQ DE WN1UIR . . ." Oh, no! What's a slash? OK, OK . . . I got it . . . "1 WN1UIR/1 WN1UIR/1 K . . ."

Almost immediately, I heard my very own callsign coming through the speaker of the HW-16 at approximately the same speed I had been sending, which was, of course, about three times the speed I could copy. I got as far as W4S, then froze. Luckily, my friend was copying along, and he quickly showed me the station's callsign circled on the top of his piece of paper. Phew!

I sent both callsigns, then imitated the few QSOs I had watched my friend make. I sent my name, QTH and signal report. I also managed to say that it was my very first QSO, then sent "HW CPY?" and both callsigns again. After the KN, I quickly grabbed my pencil, determined to show my friend that I had actually passed the Novice code test.

"FB DAVID—NAME HR IS BILL BILL BILL—QTH IS DALLAS DALLAS—UR RST RST IS . . ." Jeez, this is tiring! Ohmaged, I hate numbers! What was that? Did you get that? He's speeding up! Calm down . . . Calm Down! . . . CALM DOWN!! Forget about what you missed. Just start copying again.

"SB—SO BK TO YOU DAVID—WN1UIR/1 DE WAS . . ."

My friend quickly showed me his perfect copy, filling in the half that I had

missed. My RST was 569, with QRM and QSB. What was that? Oh yeah . . . I remember . . . interference and fading. OK . . . my turn again. Gee, my hand hurts!

" . . . DE WN1UIR . . ." What was the slash? I forgot the slash! Oh, yeah, ". . . /—FB BILL—SLD CPY HR—" Now what do I say? I have absolutely nothing to say to this guy. Maybe if I just shut the rig off he'll think I had a heart attack or something. Or maybe he'll spend the next few days fruitlessly calling WN1UIR/1, finally turning my callsign over to the FCC as a rude and shameless example of a bad amateur radio operator. I'll lose my license. I'll be fined . . . thrown in prison . . . my Dad will lose his job and my family will be ridiculed and scorned!

My friend saved me from this dreadful fate by suggesting, "Why don't you tell him what rig you're using, then tell him that you're operating from a friend's house? Since you're not in the *Callbook* yet, you could tell him you really want his QSL card, then send your address. Then, maybe mention the nice spring day we're having. Tell him how old you are, and that you got your license at your high school radio club."

Great ideas! I launched into a 10-minute monologue mentioning each and every one of these things. I always found it much easier to send CW than to receive, so I had no trouble banging away, though I lost my place a few times and I'm sure I misspelled a few words. After finishing my life's story, I turned to my friend and asked, "Now what do I do?" "How about letting him talk for a while," he helpfully suggested. Darn, that means I have to copy again. Oh well, I guess there's no way to avoid it. I sent the callsigns and grabbed for my pencil.

There were at least three other CW signals coming through the speaker now, none of which I could copy. My friend said he had our station, pointed out which one of the CW signals was the W4S's, then we both struggled to copy the fading signal:

" . . . QSB . . . QSL OK . . . SAY 73 73 ES . . . AGN . . . DE WAS . . ."

Now what do I do? I didn't get any of that! I can't respond if I don't know what he said!

My friend calmly explained that my W4S was saying good-bye, and that I should tell him that the QRM and QSB were getting worse, thank him for the QSO and say 73 . . . which I did like an old pro (if I do say so myself).

That was it. My first QSO. I was officially an amateur radio operator. We looked up Bill's address in the *Callbook*, and I sent out my first QSL card, writing "Transfer my first QSO!" on the back. A week or so later, a glossy black QSL card with silver printing showed up in my mailbox.

Since that day, I've had thousands of contacts using many different modes. Most of them are just letters written in a logbook, but I'll always remember that first one . . . and the patience of my friend and that ham in Dallas.

A few years ago I had the privilege

*Continued on page 62*

# PROPAGATION

Number 31 on your Feedback card

Jim Gray W1XU

Jim Gray W1XU  
210 East Chateau Circle  
Payson AZ 85541

The summer doldrums . . . you're probably tired of hearing that by now. July is not considered a particularly good month on the HF bands because of the high QRN levels and the high absorption of signals surrounding midday. However, short skip will prevail on some bands during daylight hours, and there will be reasonable DX in the mornings and afternoons (local time). Here's what you can expect for general conditions.

## 10 Meters/12 Meters

Some north/south DX paths open in the afternoon. Short skip out to 1,200–1,500 miles should be good on most days (calendar symbol "G," "G-F," "F-G").

## 15 and 17 Meters

There will be fairly good DX to countries below the equator during daylight hours (only on "Good" days), peaking during the afternoon. During the day, there will be good short-skip and sporadic E communications out to about 1,500 miles (for example, some east/west paths to Africa on "Good" days).

## 20 Meters

This is the DX band of choice during July, and worldwide DX can be expected on days marked "Good" (G) on your calendar. Best conditions during the day will be shortly after sunrise and shortly after sunset, although the band will stay open after dark. Excellent short-skip openings will take place throughout the day.

## 40 and 30 Meters

Evening, nighttime and early morning hours will provide DX on the "Good" (G) days. Around midnight the DX will be toward Europe; just before sunrise it will be toward Oceania and the Far East. Short skip will be excellent during daytime. As always, thunderstorm activity and high noise levels will dim the results on some days.

## 80 and 160 Meters

Neither band will show much

daytime activity because of the high absorption of signals. Nighttime DX will depend on atmospheric noise levels (QRN), but you can expect some DX on the "Good" (G) nights. Short-skip will prevail on 80 during the day and night, with nighttime short skip out to 2,000 miles or so. You can also find short skip out to 1,000 miles or so during the night on 160 meters.

## Using the Calendar

The last week of the month is expected to be the worst for operating, with the 28th through the 31st being particularly poor. For best conditions look at the "Good" (G) days and for trends from "Fair to Good" (F-G). It is possible that severe weather and other geophysical phenomena will take place on or around the days marked "Poor" and "Very Poor." Batten down the hatches and be alert for warnings around the 28th-30th, the days marked "Poor" and "Very Poor."

GMT	00	02	04	06	08	10	12	14	16	18	20	22	
ALASKA	-	20	-	-	20	20	-	-	-	-	-	-	
ARGENTINA	20	-	-	-	-	-	-	-	-	10/15	15	-	
AUSTRALIA	15	-	-	-	-	20	20	-	-	-	-	15	
CANAL ZONE	15	20	20	40	40	-	20	20	10	10/15	10/15	-	
ENGLAND	-	-	-	-	-	-	-	15	15	15	15	-	
HAWAII	15	20	-	-	40	40	20	20	-	-	-	15	
INDIA	-	-	-	-	-	20	20	-	-	-	-	-	
JAPAN	-	-	-	-	-	20	20	-	-	-	-	-	
MEXICO	15	20	20	40	40	-	20	20	10	10/15	10/15	-	
PHILIPPINES	-	-	-	-	-	-	20	20	-	-	-	-	
PUERTO RICO	15	20	20	40	40	-	20	20	10	10/15	10/15	-	
SOUTH AFRICA	-	-	-	-	-	-	-	-	-	15	15	20	
U.S.S.R	-	-	-	-	-	-	-	-	-	-	-	-	
WESTCOAST	20	0040	0040	0040	0040	-	-	-	-	15	20/15	20/15	-

## CENTRAL UNITED STATES TO:

ALASKA	15	20	-	-	-	-	-	-	-	-	-	-
ARGENTINA	15	20	40	-	-	-	-	-	-	-	10/15	15
AUSTRALIA	19/20	20	20	-	-	40*	40*	-	-	-	-	15/20
CANAL ZONE	20	20	40	-	-	-	-	-	-	15	15	15
ENGLAND	-	40*	40*	-	-	-	-	-	-	15	15	20
HAWAII	15	20	20	10/40	40	40	-	-	-	-	-	15
INDIA	-	-	-	-	-	-	-	-	-	-	-	-
JAPAN	15	20	-	-	-	-	-	-	-	-	-	-
MEXICO	20	20	40	-	-	-	-	-	-	15	15	15
PHILIPPINES	15	-	-	-	-	-	-	-	-	-	-	-
PUERTO RICO	20	20	40	40	40	-	-	-	-	15	15	15
SOUTH AFRICA	20	-	-	-	-	-	-	-	-	-	-	-
U.S.S.R	-	-	-	-	-	-	-	-	-	-	-	-
EAST COAST	20	0040	0040	0040	0040	-	-	-	-	20	15	20

## WESTERN UNITED STATES TO:

ALASKA	15	15	20	20	20	20	20	20	20	20	20	20	
ARGENTINA	15	20	40*	-	-	-	-	-	-	-	10/15	15	
AUSTRALIA	15	20	20	-	-	-	-	-	-	-	-	15	
CANAL ZONE	20	20	40/20	40/20	-	-	-	-	-	20	15	15	
ENGLAND	-	-	-	-	-	-	-	-	-	-	20/15	20/15	
HAWAII	20/15	20/15	40	40	40	40	-	-	-	-	20/15	20/15	
INDIA	15	15	15	-	-	-	-	-	-	20	20	-	
JAPAN	15	15	20	20	20	20	20	-	-	-	-	10/15	
MEXICO	20	20	40/20	40/20	-	-	-	-	-	20	15	15	
PHILIPPINES	15	15	20	20	40	40	-	-	-	-	15/20	20	
PUERTO RICO	20	20	40/20	40/20	-	-	-	-	-	20	15	15	
SOUTH AFRICA	20	-	-	-	-	-	-	-	-	-	-	-	
U.S.S.R	-	-	-	-	-	-	-	-	-	-	-	-	
EAST COAST	20	0040	0040	0040	0040	-	-	-	-	-	15	20/15	20/15

\*No DX possible on good days only

JULY 1993												
SUN	MON	TUE	WED	THU	FRI	SAT	1 G	2 G	3 G-F	4 F-P	5 P	6 P-F
							1 G	2 G	3 G-F	4 F-P	5 P	6 P-F
11 F-P	12 P	13 P-F	14 F	15 F-G	16 G	17 G				11 F-P	12 P	13 P-F
18 G	19 G	20 G	21 G-F	22 F	23 F-G	24 G				18 G	19 G	20 G
25 G	26 G-F	27 F-P	28 P-VF	29 VP	30 VP	31 VP-P	25 G	26 G-F	27 F-P	28 P-VF	29 VP	30 VP



"The FT-416 comes in black - or gray!"

"New sculpted design, built-in VOX,  
back-lit DTMF pad, Yaesu's  
"Straight As"! Wow!"

"Yaesu did it again!"



In great design "form follows function." Only then does breakthrough design evolve. Our new generation of HTs exemplifies this with the exciting FT-416.

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## FT-416/816 2-Meter/70cm Handheld

- Frequency Coverage  
FT-416:130-174 MHz RX  
140-150 MHz TX  
FT-816:430-450 MHz RX/TX
- 41 Memories (Odd splits on any channel)
- 4 TX Power Levels  
w/FNB-25 2.0, 1.5, 1.0, 0.5W  
w/FNB-27 5.0, 3.0, 1.5, 0.5W
- CTCSS Encode/Decode
- ATS, Automatic Tone Search
- ATT, Advanced Track Tuning
- ABS, Automatic Battery Saver
- APO, Automatic Power Off
- Direct 12V DC Input (5 Watts Output) 5 Watts w/FNB-27 Battery
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- Built-in VOX
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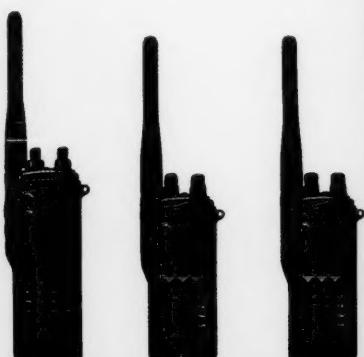
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- **Alphanumeric memory**  
Alphanumeric data (max. 6 characters) can be entered directly into memory.
- **Alphanumeric message paging**  
In addition to standard DTSS and paging functions, alphanumeric messages can be stored in memory for immediate transmission.
- **Dual-frequency receive**  
In addition to full-duplex cross-band operation, the TH-78A is equipped to receive two frequencies simultaneously, even on the same band. There's also independent double-band scan and ABC (automatic band change). The TH-28A and TH-48A feature dual-band receive capability, enabling semi-duplex cross-band operations (TH-28→TH-48A).
- **Frequency coverage**  
TH-28A: 118-173.995 MHz, sub RX: 438-449.995 MHz; TH-48A: 438-449.995 MHz, sub RX: 136-173.995 MHz; TH-78A: 118-173.995, 438-449.995 MHz. Transmit on Amateur bands only. (MARS/CAP modifiable, permits required).
- **2.5W power with supplied battery pack**  
5W with 12 VDC power source (PB-14, PB-17, or external DC).
- **Non-volatile memory**  
The TH-78A has 50 memory channels (expandable to 250 with the ME-1 option), while the TH-28A and TH-48A have 40 channels (expandable to 240 with the ME-1 option).



## TH-78A/28A/48A

FM Handheld Transceivers

